



A strategy for a developmental green economy for Gauteng

Final Report

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1 This document

During 2009, the Gauteng City-region Observatory (GCRO) undertook a study of how sub-national units across the world were responding to the global financial crisis, commissioned by the Gauteng Department for Economic Development. A key finding of that study was the many cities, city-regions and other similar areas were investing heavily in 'green' technologies, creating green jobs, and preparing for a post-crisis context where sustainable growth – low carbon economies, 'green' jobs, enhanced quality of life – were the norm; and where there was a need to avoid environmental taxes and penalties.

Late in 2009, the MEC for Economic Development in Gauteng, Hon Firoz Cachalia, approached the GCRO to develop a 'green economy' strategy for the province, as part of a broader Gauteng Growth Employment and Development Strategy (GGEDS). This created considerable logistical challenges, given that the GGEDS was due in late January, and the team convened by GCRO had some 6 weeks to develop this strategy document; to do so, the team had to work through the December holidays. Frank Spencer in particular worked beyond the call of duty in putting this document together on time and within budget.

Although colloquially referred to as the 'green jobs' strategy, this is really about sustainable development. Gauteng cannot adopt some green options here and leave dirty options elsewhere; green jobs are an output of a broader decision to embrace a low carbon future, with all the implications that entails – many of which are spelled out in the second part of this document.

The strategy is a first draft, written in some haste, and with the best data available to the authors. The authors are drawn from various institutions, many are leaders in their fields, and we thank them for making their time available at such short notice.

The strategy is summarised up front, in some 20 pages of key points, economic impact, job creation, and related data. Thereafter, each key initiative is developed in greater detail, and the reader can follow the argument, modelling and outputs in greater detail. The strategy also summarises South Africa's 'green' commitments – the policy framework within which the document has been written – and ends with both some international comparative examples, and alternative funding options available to support the green strategy.

Two points need to be made:

1. Firstly, this document sets out a broad range of policy options from which the Gauteng Provincial Government (GPG) may select those it feels most appropriate. In some instances, those policy options have themselves been broken down by scale, providing a suite of options for GPG. Once GPG makes its policy choices, the options it selects will have to be properly modelled, design and rolled out. This strategy provides an overview, albeit with considerable detail; but it is not a programme design document, which will have to follow later in the process.
2. Secondly, taking up the options proposed here would put Gauteng at the cutting edge of green and sustainable economic development worldwide.

Sustainable economic development makes social and economic sense. Economic growth is boosted, and on a viable ecological and social footing. Green jobs thus become the norm, not an 'add-on'. This is the future for Gauteng proposed in this strategy.

The strategy

Strategic agenda for 2010

Over the next 15 years, the Gauteng Provincial Government will design, manage and implement a systematic programme aimed at building a low carbon, resource-productive economy that creates new 'green' jobs and reduces environmental impacts.

The overall strategic goal is sustainable economic growth and sustainable job creation for Gauteng.

The Department of Economic Development (DED) will lead this programme, given its mandate of both growth and job creation – this strategy is based on sustainable growth where the purpose of growth is job creation. The DED will work with other provincial departments, as well as the local and national spheres, the private sector, civil society, labour and the universities, which have a key role to play in the strategy.

The DED will act in different ways depending on the strategic objective and context. In addition to funding and implementing its own initiatives, it will also play various roles such as facilitator, catalyst, partner, and regulator.

Key initiatives

Greening the economy will be achieved by pursuing the following overarching programmes, with more to follow over time:

- Food security: reducing food imports and (vastly) increasing local food production
- Energy security: reducing dependence on oil and coal-based sources of energy by increasing the supply of renewable energy and improving energy efficiency
- Water security: reducing total water consumption by 15% by improving efficiencies, introducing recycling, increased public education, and reversing pollution via more effective management of Gauteng's water resources and associated eco-system services
- Zero waste: by seeing all waste outputs as potential productive inputs, measures will be introduced to reduce, recycle and re-use
- Sustainable mobility: to reduce dependence on oil and limit carbon emissions, investments in public transport systems will be accelerated so that the number of trips in private vehicles can be reduced by 15%

Provincial government as a whole will drive two over-arching programmes:

- Sustainable human settlements: building socially integrated human settlements that are designed to reduce distances between home and work, generate more energy than they use, recycle waste, use less water and are built from the most sustainable building materials
- Efficiency: a cross-cutting programme aimed at maximising resource efficiency in all the above resource use areas (water, energy, etc.)

Implementation and DED

To ensure implementation of these programmes, DED will play the following roles in the different areas.

Food security

Overall aim: job creation through local food production

Key partners: Departments dealing with agriculture and rural development; the wholesale agricultural produce markets at municipal level; supermarket chains; farmer's associations; sector NGOs.

DED role: mainly as *facilitator* to support existing and foster the establishment of new agribusinesses to produce and supply agricultural produce; to *commission* research identifying land for agribusiness establishment and other points of intervention.

Primary action:

- Rapid strategic analysis of existing value chains to identify points of intervention
- Formalisation of a Gauteng Food Security Partnership, including co-funders
- Initiation of first generation projects and rigorous monitoring, evaluation, lesson learning and communication
- Investment support service for low external input farming methods

Budget: R5 million to be used primarily for security specialist expertise to support a core group of full-time staff who will act as facilitators, also for co-funding first generation projects

2 Energy security

Overall aim: To protect the Gauteng economy against increasing energy costs and fuel shortages

Solar water heating industry

Overall aim: to establish a diversified local Gauteng solar industry

Key players: local sphere, solar water heater industry players, insurance industry (which purchases the majority of geysers sold in South Africa), potential manufacturers

DED roles: mainly as *facilitator* to secure regulatory change at local government level; as *funder*, to build solar water heater production capacity/industry; as *provider* of Breaking New Ground (BNG) top-up subsidies

Primary actions:

- Bring solar water heater industry players and local government together to agree on a regulatory framework focusing mainly on new developments and resale (and retrofits)
- Investments aimed at incentivising increased capacity to produce and install solar water heater systems (e.g. training, industrial park materials development, SABS standards approval)
- BNG top-up subsidies
- Special strategy to ensure that the homes of the Premier, all MECs and MPLs, and all buildings owned by the Gauteng provincial Government are fitted with solar water heating systems

Budget: R20 million, most of which will be spent on BNG top-up subsidies.

Energy Efficiency

Overall aim: to reduce the energy intensity of the Gauteng Economy, thus reducing the carbon footprint of goods and services produced in Gauteng; to meet the Gauteng Integrated Energy Strategy target of a reduction in energy consumption of 15% by 2025.

Key players: National Business Initiative (NBI); National Energy Efficiency Agency (NEEA); ESKOM Demand Side Management (DSM); South African National Energy Association (SANEA); Southern African Association for Energy Efficiency (SAEE); large energy consumers; GEDA

DED role: primarily facilitation

Primary actions:

- Conduct and Energy Efficiency Audit all government buildings and cost the life cycle savings from energy efficiency interventions.
- Set minimum energy efficiency standards for new government buildings and projects.
- Support municipalities in passing bylaws to set minimum energy efficiency standards (e.g. SANS204 to be applied to all new buildings).
- Facilitate the creation of a Gauteng Energy Efficiency Association to facilitate discussion and projects between government, business and other stakeholders.

Budget: for EE: R2 million for audits and facilitation

Concentrated solar power (CSP)

Overall aim: to make Gauteng a local and global leader in CSP technology innovation and generation and provision; to meet the Gauteng Integrated Energy Strategy target of a 16% supply of renewable energy by 2025.

Key players: Top 100 companies (who have signed carbon disclosure agreement and are looking for clean energy); local sphere; ESKOM; private investors; CSP experts; GEDA; South African National Energy Association (SANEA); Centre for Renewable and Sustainable Energy Studies (CRSES).

DED role: primarily facilitation

Primary actions:

- Detailed feasibility study
- Legally binding agreement brokered between ESKOM, GPG and local sphere in Gauteng allowing Gauteng's major industrial players to purchase green energy
- An investment consortium to pay for construction
- Identification of appropriate locations for CSP plants (including the possibility of non-Gauteng locations)

Budget: for CSP: R2 million for expert studies and facilitation work

3. Water Security

Overall aim: to empower DED to actively prevent water services and water supply from undermining future economic growth in Gauteng. This can only be achieved by decreasing total consumption of water by 15% which, in turn, can only be achieved by reducing the water intensity of the Gauteng economy, improving efficiencies and reversing the high levels of pollution of water resources and associated ecosystem services.

3 Long-Term Water Supply

Key players: Rand Water Board, ERWAT, local governments, Department of Water Affairs, potential private sector players, Universities, CSIR, DBSA and Water Research Commission.

DED role: primarily as facilitator

Primary actions:

- Establish the Gauteng Water Resources Group (GWARG) to review the adequacy of long-term water supply planning and the actions required now to prepare for this
- Identify a programme of projects to be implemented over next 5 to 10 years with associated funding sources with major job creation potential

Budget: R1.5 million mainly for the establishment of the Gauteng Water Resources Group and the commissioning of the review document

Water Demand Management

Key players: Rand Water Board, ERWAT, local governments, Department of Water Affairs, potential private sector players, Universities, CSIR, DBSA and Water Research Commission.

DED role: primarily as facilitator

Primary actions:

- Under the auspices of the GWARG review the current already approved water demand targets that have already been set and the level of non-compliance
- Agree on key interventions with local governments, in particular with respect to the reduction of Unaccounted for Water
- Focus on mining and major industrial establishments and on how they can become more self-sufficient via water recycling

Budget: R1.5 million for review and strategic interventions – a larger capital budget may be required in 2010 to supplement local government budgets for funding key capital interventions.

Pollution Reversal

Key players: Rand Water Board, ERWAT, local governments, Department of Water Affairs, potential private sector players, Universities, CSIR, DBSA and Water Research Commission, plus the Gauteng Department responsible for the environment.

DED role: primarily as facilitator

Primary actions:

- Rapid collation of existing studies of pollution levels and degradation of eco-system services (CSIR is main repository of all this)
- Under the auspices of the GWARG, identify key hotspots and urgent remedial actions (mainly mining activities, major steel production and either non-existent or badly maintained sanitation services) – e.g. pollution of the Vaal River, groundwater pollution on the East Rand and Vaal Triangle, Haartebeespoort Dam
- Identification of regulatory interventions and policing thereof, including role of the Green Scorpions
- Identification of key interventions – could be of a capital nature, or operational or both – the most viable short-term options could well be public works type labour intensive clean-up operations where local government budgets are supplemented by DED contributions.

Budget: R1 m for 2010, with major potential for a significant capital budget in 2011. But an additional R5 for public works projects aimed at clean up

Sanitation

Key players: Rand Water Board, ERWAT, local governments, Department of Water Affairs, potential private sector players, Universities, CSIR, DBSA and Water Research Commission, plus the Gauteng Department responsible for the environment, plus Gauteng's human settlements department

DED role: mainly as facilitator, but together with human settlements there may be a regulatory role.

Primary actions:

- Rapid collation of existing information on sanitation backlogs in each municipality, including funding strategies and time frames for eliminating these backlogs
- Detailed study of sustainable technologies that can be deployed to re-use all the wastes and capture for re-use, in particular the methane, water and nutrient content, with major job creation potential
- Working closely with human settlements, the introduction of dual supply systems (so that toilet flushing is with low cost grey water) coupled to neighbourhood-level treatment systems, with major job creation potential
- Repair and upgrade of deteriorating sanitation systems – much of this could be public works type work

Budget: R2 million for review and detailed studies, plus R10 million for a pilot project with human settlements and private sector developers to introduce a neighbourhood treatment system in a particular settlement coupled to a dual water supply.

4. Sustainable Mobility

Key players: Gauteng Department of Transport will be the most important, but also local governments, National Department of Transport, and many other players.

DED role: mainly as facilitator, although there may be a regulatory or a funding (and public education) role. DED must make it clear that oil dependence, congestion and expenditure on roads is a potential threat to future economic growth. DED's main role may well be to put in place a strategic framework for monitoring whether progress is being made or not towards a sustainable mobility system for Gauteng, and whether this is moving fast enough.

Primary actions:

- Reach agreement with Department of Transport on the most constructive role that DED could play, taking into account the resources such as GEDA and Blue IQ that DED can bring into the process
- Review and establish targets for Gauteng, and assess whether current investment strategies to increase the supply of public transport are adequate (e.g. BRT, Gautrain etc.)
- Public communication and education about the need to shift to low carbon transport and away from private vehicular travel as the primary means

Budget: R1.5 million

Strategy for a developmental Green Gauteng (summary)

“**Climate change** is a practical matter for the developing world, especially Africa... For countries such as South Africa, weather patterns in coastal provinces are already wreaking havoc on the lives of our people, which makes this challenge a reality that we are already confronting... We, the leaders of the world, need **to seize our historical opportunity** to act now to safeguard the future of humanity and the planet it inhabits. We owe it to current and future generations.”
Pres. Zuma, COP15 Copenhagen, December 18th, 2009

"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 African Finance Minister Trevor Manuel, Budget speech, Parliament February 20th, 2008

1.1 Introduction to the Green Economy

Global economic thinking is currently experiencing a paradigm shift from the current capital-focussed resource-intensive development towards what is being called the “Green Economy”. **A Green Economy is one in which business processes are infrastructure reconfigured “to deliver better returns on natural, human and economic capital investments, while at the same time reducing greenhouse gas emissions, extracting and using fewer natural resources, creating less waste and reducing social disparities.”**¹ Thus a Green Economy “grows by reducing rather than increasing resource consumption”^{2,3}. These economies have also been termed **low-carbon economies**.

For South Africa, this issue has been raised in the Cabinet-approved Long Term Mitigation Strategy for Climate Change:

¹ UNEP, *Global Green New Deal: An Update for the G20 Pittsburgh Summit*, ii.

² Swilling, *Growth, Resource Use and Decoupling: Towards a ‘Green New Deal’ for South Africa*, 5.

³ This process is also known as “dematerialisation”.

“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-eq, more than three times South Africa’s annual emissions of 446 Mt in 2003)” (LTMS 2008 pg 27).

This shift to low-carbon economies has intensified due to the recent economic crisis, inspiring organisations to direct programmes to create **green jobs, which is “work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality.”**⁴

At an international level this led to South Africa joining with the other G20 nations to make a number of recent commitments in this space:

- **“We will make the transition towards clean, innovative, resource efficient, low carbon technologies and infrastructure.”**⁵
- **“As leaders of the world’s major economies, we are working for a resilient, sustainable and green economy.”**⁶

The change in thinking that is required to achieve these goals includes:

- Environmental protection must no longer be viewed as a **constraint** to economic growth, but as a **driver of growth** and essential for long-term economic sustainability⁷.
- Production and consumption must no longer be viewed as “linear” processes, but must be thought of and consciously designed using holistic life cycle/circular concepts⁸.
- A shift from capital-focussed investment to **strategic investments in knowledge capital** and the systems that create **innovation**.

It will be up to Gauteng as the economic heart of South Africa to drive these goals and create sustainable jobs through a sustainable use of resources and a reduction in carbon intensity. Adopting the measures proposed here would catapult Gauteng **to the cutting edge of green economies world-wide**.

⁴ UNEP, *Green Jobs: Towards decent work in a sustainable, low-carbon world*, 3.

⁵ G20, London, 2 April 2009

⁶ G20, Pittsburgh, 24-25 Sept 2009

⁷ UNESCAP, *Green Growth at a Glance*, 13.

⁸ Ibid.

1.2 Green Economy Benefits

Green Economies focus on

- Initiatives that **protect the basic requirements of human beings** (food, water, etc);
- **Technology initiatives** that make it possible to do **more with less**, including reduced **energy input per unit of output**, **reduced** carbon emissions and **more efficient use** of primary resources;
- Technology initiatives that **produce energy from low carbon & renewable energy** sources.

These initiatives can achieve significantly increased jobs, and also reduce carbon emissions without any reduction in GDP growth. In addition, it can be argued that these initiatives protect jobs that may otherwise be lost due to increasing resource constraints and energy costs.

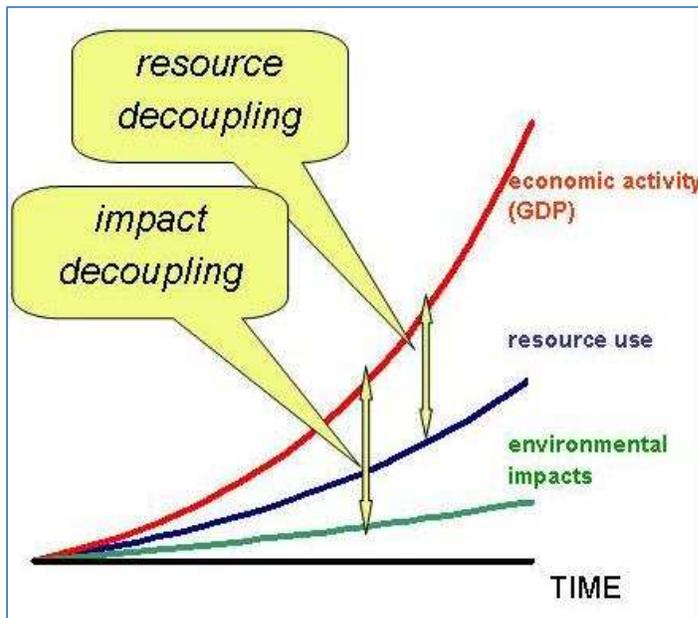
1.3 Gauteng Macro-Economic Challenges

There are a number of new and old constraints to growth in Gauteng. These include:

- Increasing **food insecurity**, as Gauteng is very dependent on food grown outside its borders. The impacts of peak oil, climate change and energy shortages are likely to raise food prices in the near future.
- Increasing **energy insecurity** due to rising oil prices, coal prices and issues related to electricity delivery from ESKOM, including the inevitability of carbon taxes.
- Increasing **water scarcity**. Gauteng is close to the limits of how much water can be delivered, and supply is likely to decrease due to contamination of water sources and reduced rainfall from climate change.
- High levels of **poverty, inequality, unemployment & illiteracy**.

1.4 Measuring Success

Success of these 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 “dematerialization”. 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, in other words, **an increase in the efficiency** with which resources are used. Resource productivity can usually be measured unequivocally: it can be expressed for a national economy or for an economic sector or even for a certain economic process or production chain **by dividing added value by resource input (e.g. GDP/Domestic Material Consumption)**. If this quotient increases with time, resource productivity is rising. Another way to demonstrate resource decoupling is comparing the gradient of economic output across time with the gradient of resource input: if the latter is smaller, there is resource decoupling.

Impact decoupling, by contrast, refers to **the relation between economic output and (various) environmental impacts**. There are environmental impacts associated with the extraction of resources required (such as groundwater pollution due to mining or agriculture), environmental impacts from production (such as land degradation, wastes and emissions), environmental impacts associated with the use phase of commodities (for example mobility resulting in CO₂ emissions), and there are end-of-pipe environmental impacts (again wastes and emissions). Methodologically, these impacts can be estimated by life cycle analysis (LCA) in combination with various input-output techniques. **If environmental impacts become dissociated from added value in economic terms, there is impact decoupling**. 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.⁹

⁹ 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.

1.5 Key Policies

Policy interventions to enable a Green Economy should revolve around the following core drivers:

- 1) Creation of both new skills and jobs in new green-driven industries;
- 2) Promote innovation in existing processes and new technologies;
- 3) Promote both local and foreign investment into Gauteng;
- 4) Decouple growth from resource consumption, especially dependency on fossil fuels;
- 5) Improve efficiency in energy and resource consumption;
- 6) Promote energy security and reduce dependency on crucial imports (e.g. oil);
- 7) Respect ecological limits;
- 8) Design for virtuous circles i.e. cradle-to-cradle economies, reduce-recycle-reuse;
- 9) Promote equity & fairness to both people and the environment;
- 10) Shift energy supply from Centralised Fossil Fuel systems to Decentralised Renewable Energy Systems;
- 11) Create food security and alleviate poverty.

Some of the core policies that could be addressed include

1) Energy

- a. Allow entities to generate their own energy and sell excess into the grid
- b. Set binding renewable energy targets with strong regulatory certainty
- c. Remove subsidies for high-carbon fuels and penalise inefficiency
- d. Promote stringent energy efficiency standards for all sectors
- e. Fast tracked skills training in energy efficiency
- f. Public education programs on energy efficiency and renewable energy
- g. Promote strong demand-side management programmes

2) Climate Change

- a. Set emission reduction targets to keep global warming below 2 degrees C

3) Resources

- a. Promote large scale local food production
- b. Establish an ecological accounting system to monitor the state of environmental services
- c. Establish a water management programme
- d. Promote waste management programmes, especially recycling & reuse of building materials.

4) Transportation

- a. Promote low carbon transportation systems
- b. Remove subsidies for fossil fuel and penalise inefficiency (high fuel consumption)
- c. Establish a long-term strategic shift away from private car use and support for mass transit, public transport, rail, etc.

5) Social

- a. Measure Gross National Happiness
- b. Prioritization of eco-efficiency indicators as measurements for benchmarking development progress
- c. Run public awareness raising campaigns about the significance of climate change, resource scarcity and Low Carbon Green Growth

6) Financial

- a. Establish green taxes (e.g. carbon and energy taxes, fuel charges, congestion pricing)
- b. Invest in sustainable green infrastructure
- c. Government-backed financing for new green business initiatives
- d. Promotion of eco-industrial parks and smart growth zones (e.g. zero carbon/zero waste IDZ)

7) Economic

- a. Promote growth through innovation and skills in green technologies
- b. Government funded technical vocational and educational training (TVET) for developing new green skills, especially for small and medium-sized enterprises and in innovation.

1.6 Summary of Proposed Initiatives

1.6.1 Local Food Production

Local food production has significant opportunity to create jobs while strengthening **food security**. In addition, this protects existing jobs through ensuring adequate, low-cost food is readily available. This has multiple benefits including improved health/lowered burden on state health system, improved calorific intake for children/improved concentration at school, and so on.

Recommendation	Job Creation Potential	Costs	Benefits
<i>(1) Urban Agriculture</i>		Investment into basic infrastructure, capacity building and support	Food security, job creation, economic growth, building social and environmental capital, provision of free ecosystem services
Scenario 1	None direct. (Food production for poorest households)		
Scenario 2	387,022 households receive supplementary income		
Scenario 3	444,538 direct jobs created		
<i>(2) Land Reform</i>	28,718 direct jobs created	Investment into basic infrastructure, capacity building and support	Land reform, food security, job creation, economic growth
<i>(3) Regionalising the value chain</i>	High, needs further research work	Facilitated industry dialogue to identify opportunities for regionalisation and	Multiplier effect on regional economy, job creation, increased efficiencies,

		increasing efficiencies	economic growth, promoting sustainable best practice
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The following key steps would be needed:

- Ensuring access to social grants for 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;
- Focussing on opportunities for small food producers, manufacturers, distributors and retailers to access markets;
- A provincial commitment to a regional procurement programme.

To achieve this level of food production and security, the DED will need to lobby others to work with them, especially the Departments of Agriculture, Social Development, and Land. Much of this could be implemented as a public works programme, with for example the Community Employment Programme providing training, support, aftercare and so on.

1.6.2 Solar Water Heaters

Based on the proposed Gauteng 2025 target of 95% penetration into mid- to high-income houses and 50% into low-income houses, more than **6,700 jobs can be created**.

Total number of high-income sector systems to be installed	1.3 million
Total cost to consumers to install all high-income sector systems (discounted (10%) to 2009 Rand for later installations)[1]	R 6.7 billion
Total electricity saved per year when all high-income sector systems installed	2,413 GWh
Estimate of annual electricity bill savings per high-income household per year ¹⁰	R 1,143
Carbon emissions averted per year when all high-income sector systems installed (metric ton)	2,109,635 tons
Total number of low income sector systems to be installed	666 thousand
Total cost to install low-income sector systems	R 1.2 billion
Total electricity saved per year when all low-income sector systems installed	543 GWh
Estimate of annual electricity bill savings per household per year ¹¹	R 651
Carbon emissions averted per year when all low-income sector systems installed (metric ton)	712,215 tons
Carbon Credit revenue per year when all low income sector systems installed (discounted (10%) to 2009 Rand) (mil Rand)	R 11.7 million

¹⁰ 2009 CoJ tariffs

¹¹ ibid

Total jobs created to achieve all high and low income installation targets with maximum local content	6,707
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What the market requires to grow is regulatory certainty. We would recommend the following policy interventions to enable the market in Gauteng:

- . New build: Mandatory installation at time of building.
- . For High-income houses: Mandatory installation. This can be on sale of the house or within a certain timeframe. Alternatively, a levy can be charged on houses that do not have SWH and used to subsidise low-income SWH.
- . Low-income houses: 50% subsidy, 50% recovered on loan basis
- . Subsidy value (low-income): R 39 million per year for 15 years
- . Possible Carbon revenue of up to R 12 million per year

So in the high-income bracket, the consumer bears the cost (less the Eskom subsidy). In the low-income bracket, a 50% subsidy, 50% loan (recoverable) is offered – R39/year for 15 years – the loan can be recovered via rates or as a small cost on electricity billing, and possible carbon credits of up to R12 million PA will be available.

1.6.3 Energy Efficiency

A 20% Energy Efficiency target could create over **10 400 jobs**, **add R 640 million to labour income**, **reduce yearly expenditure on energy by over R16 billion** / year with additional investment in equipment at around R10 billion / year. Provincial spend for a programme to enable would be around R13 million/year.

	15% Target 2025	20% Target 2025
Business-As-Usual Gauteng Energy Consumption 2025¹²	999.5 PJ	999.5 PJ
Energy saved through efficiency	149.9 PJ saved in 2025	199.9 PJ saved in 2025
Energy cost saved¹³	R 12 billion / year	R 16 billion / year
Jobs creation potential	50 jobs/PJ¹⁴	50 jobs/PJ¹⁵
Jobs created by 2025	7,500 minimum	10,400 minimum
Monthly salary per technician	R 5000	R 5000
Total yearly salary revenue in economy	R 450 million	R 624 million
Total asset expenditure on energy efficiency equipment in economy	Approx R7.5 billion per year	Approx R10 billion/year
Economic return on energy efficient initiatives	Typically 2x on investment over 4-6 years.	Typically 2x on investment over 4-6 years.
Estimated cost to Province to establish programme¹⁶	R 10 million / year	R 13 million / year

¹² Dept of Local Gov & Housing, *Gauteng Integrated Energy Strategy*, 48.

¹³ Assuming the low value of R0,30 per kWh

¹⁴ Lee and Denlay, *Demand Side Management: Energy Efficiency Potential in South Australia*.

¹⁵ Ibid.

1.6.4 Concentrated Solar Power Industry

The following figures are based on meeting the proposed 16% Renewable target for Gauteng from predominantly Concentrated Solar Power (CSP).

Total amount of CSP (with 6 hours storage) to be installed if a 16% electricity from Renewables by 2025 are to be achieved	1413	GW
Estimated total cost of CSP plants to be build by IPPs	R 90.5	billion
Total conventional electricity saved per year	5.2	TWh/a
Carbon emissions averted per year (metric ton)	4 378 248	tons
Current CSP REFIT (Parabolic Trough with 6 h storage)	R 2.10	/kWh
Total new permanent jobs on CSP power plants	1000	
Number of jobs for permanent construction team (assuming 100 MW of CSP is constructed per year)	900	
Indirect jobs in the Gauteng province due to CSP plants being build	4000	new jobs per year

In addition, the price of electricity with 16% CSP is likely to be less expensive than that of 100% fossil fuel based electricity in the residential sector by 2025: R3.88/kWh for 100% coal vs R3.59/kWh for 84% coal and 16% CSP.

1.6.5 Water & Sanitation

The DED should promote and cooperate in the following programmes:

- Water demand management, through
 - Leak control programmes (in cooperation with the DBSA)
 - Household plumbing maintenance and improvement in low income communities
- Pollution reduction, through
 - Improvement of storm water infrastructure and management;
 - Improvement of sanitation in low income communities;
 - Household plumbing maintenance in low income communities;
 - Joint regional strategy, to be developed with DWA and Rand Water.
- 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.
- 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.

¹⁶ Assuming large programme to drive policy, create awareness of energy efficiency and promote skills training in energy efficiency. Figures estimate.

1.6.6 Waste Management

Waste to landfills can be reduced by up to 60% (3,885,702 tons / year) and **over 19,400 jobs can be created**.

Estimated job creation potential in each waste sector is shown by the following table:

Categories	Jobs per 10,000 TPY
Product Reuse:	
Computer Reuse	296
Textile Reclamation	85
Misc. Durables Reuse	62
Wooden Pallet Repair	28
Recycling-Based Manufacturers:	25
Paper Mills	18
Glass Product Manufacturers	26
Plastic Product Manufacturers	93
Processing Facilities:	
Conventional Material Recovery Facilities	25
Plastics Processing Facilities	18
Metal Reclaimers	26
C&D Processors	93
Composting	4
Landfill and Incineration	1

TPY = Tons Per Year
C&D = Construction & Demolition

Key drivers:

- Mandatory Recycling Efforts;
- Development of Composting Initiatives to create compost from organic waste;
- Waste Minimization Clubs to help waste producers reduce or share reusable waste;
- Waste to Energy programme to convert gas from landfills or organic waste into electricity;
- Green Procurement with low waste results;
- Multi-faceted Landfill Sites with low-carbon delivery infrastructure,

1.6.7 Transport

A 15% energy efficiency target in the transport sector could be equated with a 15% reduction in fuel consumption. The following savings and direct jobs could be achieved:

15% fuel saving	0.98 million litres per day
Required # of people to switch from private car to BRT	1.1 million people
Number of BRT busses required	2400
Job creation potential (3 shifts)	7200
Estimated Subsidy	R 850 million

Key drivers:

- Switch to low-carbon forms of transportation (i.e. public transport)
- Urban design for low distance travel between home, work and schools.

1.7 Other Initiatives

The table below gives a summary of each of the initiatives proposed above and ranks them against a number of economical, social and ecological benefits.

*** = Excellent; ** = Good; * = Poor; N/A = Not applicable	<u>Economic Benefit</u>								<u>Social Benefit</u>			<u>Ecological Benefit</u>		Responsible Agent	
	GDP	Direct Job Creation	Indirect Job Creation	New Industry	Local content	Investment	Innovation	Security	Health	Happiness	Climate Adaptation	Climate Mitigation	Resource De-coupling		
Short-Term															
Policy changes to promote low-carbon, high employment	*	N/A	N/A	*	**	**	N/A	N/A	N/A	***	*	N/A	N/A	DED, DLG (may produce draft by-laws for municipalities to approve), municipalities Office of the Premier, DED, GEDA, Blue IQ, Gauteng Tourism Authority	
Create a "Green Gauteng" brand	*	*	*	N/A	N/A	N/A	N/A	N/A	N/A	***	*	N/A	N/A	DED, Dept of Agriculture & Rural Development, municipal economic development depts, fresh produce markets	
Drive initiatives for local food production	***	***	***	*	***	**	*	***	***	***	***	**	**	DED, municipal electricity departments or utilities, municipal planning departments, DLG	
Drive initiatives for Energy Efficiency	**	*	**	*	*	**	*	*	*	*	**	*	**	DED, DLG, municipal planning depts, municipal electricity departments	
Promote, finance and skills for Solar Water Heaters	**	*	**	*	***	**	*	*	**	*	*	**	**	DED, DLG, municipal waste departments, Dept of Agriculture & Rural Development	
Compulsory Waste Management and Recycling	**	**	*	*	***	*	*	N/A	**	**	*	*	**	Dept of Agriculture & Rural Development, various municipal departments	
Promote investment in ecosystem services	**	*	**	**	**	*	**	*	*	*	*	**	***	DLG, Rand Water, municipal water depts or utilities	
Invest in water management &	***	*	*	*	**	*	*	N/A	*	**	*	**	**		

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recovery															
Forestry & Agriculture	*	*	**	*	**	*	*	N/A	*	*	*	*	*	GDACE	
Switch from electricity to LPG for cooking/heating	*	*	N/A	N/A	*	*	*	*	*	**	*	*	*	DLG, municipal planning departments, iGoli Gas	
Smart Metering	*	*	N/A	***	**	*	***	*	N/A	N/A	N/A	*	N/A	DED, municipal electricity / water depts or utilities, Eskom, Rand Water	
New Battery and Storage technologies	**	*	*	***	*	**	***	*	N/A	N/A	N/A	*	N/A	DED	
Indoor building air quality	*	*		*	*	*	*	N/A	N/A	**	N/A	N/A	N/A	Dept of Agriculture & Rural Development, municipal planning depts	
Public open space / "greening"	*	*	**		***	*	*	N/A	**	***	**	*	N/A	Municipal planning depts, municipal parks / environment depts	
Renewable Energy projects	*	**	***	**	*	***	***	**	*	**	*	***	**	DED, municipal electricity depts or utilities, Eskom	
Medium-term															
Concentrated solar plant industry	**	*	**	***	***	***	***	***	*	*	*	***	**	DED, GEDA, Blue IQ	
Green Integrated Development Zone	**	*	**	**	***	**	**	N/A	*	*	**	*	***	DED, municipal economic development departments	
Transportation	**	**	**	*	*	*	**	N/A	*	**	**	**	**	GPG Dept of Roads & Transport, National Dept of Transport, municipal depts of transport & bus services	
Sewerage reduction and sewerage-to-energy	*	*	N/A	N/A	**	*	*	**	*	*	*	**	*	DED, municipal departments of water	
Large scale Urban food production	**	***	***	*	***	**	*	***	**	***	***	**	**	DED, Dept of Agriculture & Rural Development, municipal economic development depts, fresh produce markets	
Smart Grids	*	*	*	**	*	*	**	**	*	*	*	*	N/A	DED, municipal electricity depts or utilities, Eskom	
Infrastructure	*		**	*	***	*	*	*	**	**	*	*	N/A	DED, DLG, municipal planning depts	
Compulsory Green Building standards	*		**	*	***	*	*	*	**	**	*	*	N/A		

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Mining Sustainability Programme	**	**	*	**	*	**	*	*	**	**	*	**	*	DED, national Dept of Mineral Resources, municipal planning depts, private sector
Long-term Cities as net ecological service providers	**	**	***	***	***	**	***	***	**	***	***	*	***	Dept of Agriculture & Rural Development, DLG, municipalities
Major Renewable Energy Manufacturing Infrastructure	***	*	*	***	***	**	***	***	*	**	*	***	**	DED, municipal departments of economic development, GEDA, Blue IQ, national DTI, national EDD

Figure 1: Table of Possible Initiatives and Ratings

1.8 Conclusions

“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.”

Gordon Brown, Newsweek, 28 September 2009

There are significant new challenges arising from ecological constraints to the business-as-usual approach to growing economies. To realign economies to focus **not only on GDP**, but also on **long-term sustainability, job creation and “happiness”** will require a shift from capital-focussed investment to strategic investments in knowledge capital and innovation systems. New skills will need to be developed in the areas of solar water heaters, local food production, urban agriculture, energy audits, and new investments will need to take place into infrastructure and planning around water, transportation, building systems and renewable energy production, especially solar.

Additional research is needed to flesh out what a broad green economy could look like for Gauteng. This would require a number of additional processes, including:

- Interaction with a visits to regions and cities that are currently implementing green economy strategies, especially South Korea;
- Further research work into the items proposed, particularly around the inter-linkages of challenges (such as food and water);
- Inter-departmental and cross-cutting initiatives in green strategy;
- Promoting a change in thinking that puts the poor and most vulnerable first while addressing the ecological challenges the face us. This will need to be communicated across all departments, all levels of government, and to business and trade-unions;
- DED will need to consider marshalling intellectual and communication resources to take this process further. Once policy choices have been made, specific interventions need to be properly researched and designed; and the MEC will need support in winning hearts and minds – and winning battles over economics and numbers. This can be done through the creation of a green unit in DED, or by continuing the relationship with GCRO.

These challenges that face us are immense but not unconquerable. It will take much hard work and co-operation across the spheres of governments to solve them. The alternative in the long run is that the poor with suffer and growth will falter, whereas if action is taken now, the economy will grow, but using less resources and with less environmental impact.

2 Introduction to the Green Economy

Global economic thinking is current experiencing a paradigm shift from the current capital-focussed resource-intensive development towards what is being called the “Green Economy”. A Green Economy is one in which business processes are infrastructure reconfigured “to deliver better returns on natural,

human and economic capital investments, while at the same time reducing greenhouse gas emissions, extracting and using fewer natural resources, creating less waste and reducing social disparities.”¹⁷ Thus a Green Economy “grows by reducing rather than increasing resource consumption”^{18,19}. These economies have also been termed low-carbon 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.”²⁰

This shift has been intensified due to the recent economic crisis, inspiring organisations such as the United Nations Environmental Program to promote such concepts as the Global Green New Deal²¹ where the focus of the economy is directed towards programmes to create green jobs. Green jobs are defined as “work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality.”²²

Within this movement, **cities and city regions** are playing a major role. Cities now house more than 50% of the world’s population, and consume a significant portion of the world’s resources, especially in the construction industry which has become a key driver of growth. The construction industry worldwide is responsible for 10% of global GDP, employs over 100 million people globally, uses up around 50% of global resources, uses 45% of global energy (5% during construction), 40% of water globally and 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 the issue is addressed in the short term.

London City has a plan to get 100000 electric cars on the roads, with 25000 electric charging stations and at least 1000 of the cities fleet to be electric, by 2015²³.

¹⁷ UNEP, *Global Green New Deal: An Update for the G20 Pittsburgh Summit*, ii.

¹⁸ Swilling, *Growth, Resource Use and Decoupling: Towards a ‘Green New Deal’ for South Africa*, 5.

¹⁹ This process is also known as “dematerialisation”.

²⁰ Ibid., 1.

²¹ See www.unep.org/greeneconomy

²² UNEP, *Green Jobs: Towards decent work in a sustainable, low-carbon world*, 3.

²³ London City, “Electric vehicles.”

Western Harbour, Malmö, Sweden runs on 100% renewable energy from the sun, wind, hydropower and biofuels. 40% of all commuters travel by bike. Augustenborg, Malmö has a large green roofing program and recycles 70% of its waste.

Copenhagen, Denmark won the European Environmental Award in 2006 for its work in clean waterways and environmental planning.

The change in thinking that is required to achieve these goals includes:

- **Environmental protection must no longer be viewed as a constraint** to economic growth, but as a **driver of growth** and essential for long-term economic sustainability²⁴. The alternative is that growth falters as South Africa bangs up against ecological limits and becomes penalised by the international community for its carbon emissions and related energy intensity (see *Appendix B: Additional Comments on the Economic Crisis and Ecological Limits* for more on this topic).
- Production and consumption must no longer be viewed as “linear” processes, but must be thought of and **consciously designed using holistic life cycle/circular concepts**²⁵.
- A shift from capital-focussed investment to **strategic investments in knowledge capital** and the systems that create **innovation**.

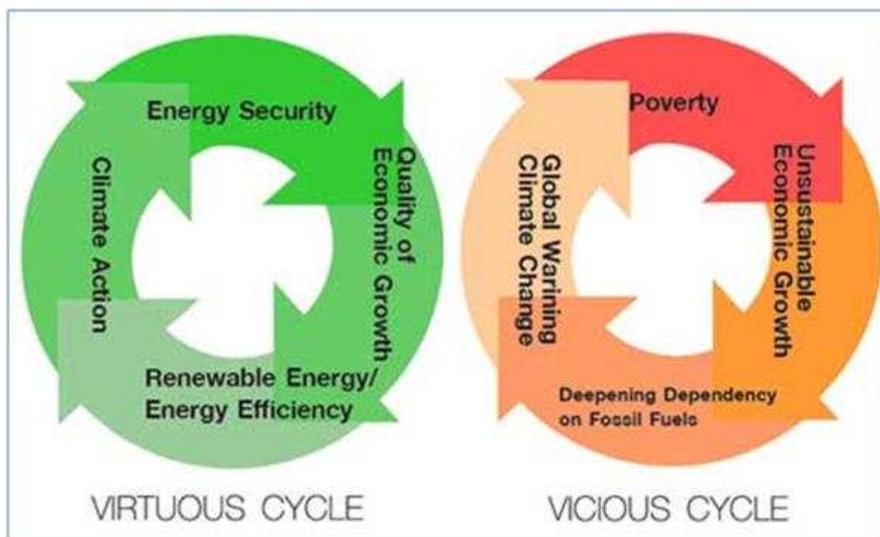


Figure 2: The virtuous cycle vs. the vicious cycle²⁶

This change in thinking has been termed eco-efficiency.

“Eco-efficiency is achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological

²⁴ UNESCAP, *Green Growth at a Glance*, 13.

²⁵ Ibid.

²⁶ Green Growth, “Green Growth.”

impacts and resource intensity throughout the life cycle, to a level at least in line with the Earth's estimated carrying capacity."

Source: *World Business Council on Sustainable Development, 2000, p. 4*

One of the key measures being used around climate change is that of greenhouse gas emissions, measured in tons of carbon-dioxide equivalent (CO_{2e}). South Africa is a large emitter, of which a significant portion is situated in the economic capital of the Gauteng region.

In the South African context, this issue has been clearly raised and documented in the Long Term Mitigation Strategy (LTMS) for Climate Change.

"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-eq, more than three times South Africa's annual emissions of 446 Mt in 2003)" *(LTMS 2008 pg 27, emphasis added)*.

At an international level this lead to South Africa joining with the other G20 nations to make a number of recent commitments in this space:

- "We will make the transition towards clean, innovative, resource efficient, low carbon technologies and infrastructure."²⁷
- "As leaders of the world's major economies, we are working for a resilient, sustainable and green economy."²⁸

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 a 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.

²⁷ G20, London, 2 April 2009

²⁸ G20, Pittsburgh, 24-25 Sept 2009

3 Green Economy Benefits

“The market for clean technologies is booming, and was in 2007 larger than the pharmaceutical industry. It will be the 3rd industrial sector in the world in 2020 (EUR 1600 billion)”²⁹

There are a number of key sectors within the green economy, but there are perhaps two broad themes that draw the spaces together.

The first is **those initiatives that act to protect the basic requirements of human beings**. These focus on protecting that which sustains us (our planet and its resources) while providing our basic needs (food & water). As will be shown, there are significant job creation opportunities in this space.

The second is in the area of **technology**. This area can be classified into the following two spaces:

- **Reduced energy consumption**/carbon emissions/resource consumption for the same service delivered (e.g. efficient motors, green buildings, etc).
- **Low carbon energy generation technologies** (e.g. solar water heaters and other renewable energy technologies).

“The exit from the crisis should be the point of entry into a new sustainable social market economy, a smarter, greener economy, where our prosperity will come from innovation and from using resources better, and where the key input will be knowledge. These new drivers should help us tap into new sources of sustainable growth and create new jobs to offset the higher level of unemployment our societies are likely to face in the coming years. However, we will only succeed if we design and implement a bold policy response. Otherwise the risk is a period of low growth which can only make it harder ... to tackle the major challenges we face today.”³⁰

“Sustainable resource management offers new opportunities for investments in innovations that could stimulate endogenous growth strategies in developing economies that could be more effective in eradicating poverty than traditional strategies that depend on primary exports or exports of cheap manufactured goods underpinned in both cases by resource depletion and/or environmental degradation.”³¹

²⁹ WWF-Netherlands, *Clean Economy, Living Planet - Building strong clean energy technology industries*, 2.

³⁰ COMMISSION OF THE EUROPEAN COMMUNITIES, “COMMISSION WORKING DOCUMENT: CONSULTATION ON THE FUTURE “EU 2020” STRATEGY,” 2.

³¹ Swilling, *Growth, Resource Use and Decoupling: Towards a ‘Green New Deal’ for South Africa*, 6.

Recent work by McKinsey (on a global scale) and the Energy Research Centre (ERC) at UCT (for South Africa) indicate that there are number of initiatives that **address the ecological issues** (especially carbon emissions) and **in the process create jobs and increase GDP, and others that also reduce carbon emissions and create jobs, but may have a negative impact GDP in the short term.**³² It should be noted that the costs due to over-use of environmental services WILL be absorbed in the economy at some point, whether or now in the future. What is important to note that it is significantly cheaper to absorb the costs now than to wait until there are major failures in the economy (as was experienced in the financial sector last year). This argument (that it is cheaper to act now than to act later) has been well made by Sir Nicholas Stern in the UK funded Stern Review.

The green economic initiatives available are summarised in the two graphs that follow. The McKinsey graph expresses the economic benefit in terms of the price of carbon, while the ERC graph expresses it in terms of GDP.

The McKinsey graph below (Figure 3) shows the amount of carbon emissions that can be saved (abatement potential) along the x-axis, and the cost implications of doing these things in terms of a cost of tCO₂. There are two key areas, one circled in green and one circled in red. The area in green shows those items that would still be worth doing, even if you were paid to emit carbon dioxide, hence the NEGATIVE cost for carbon on the y-axis for these items. Then the area in red shows those items that would require some cost for carbon (i.e. a carbon tax) before these items would be cost effective. One can note that the area under the bars in the green section is not significantly less than the area under the bars in the red section. The implication is that almost all of these initiatives can be undertaken without a carbon tax required, and the result would be a massive reduction in carbon emissions (and also a huge increase in jobs due to all the new economic activities).

The LTMS graph below (Figure 4) similarly shows which initiatives would lead to an increase in GDP and reduce carbon, and which initiatives would decrease GDP and reduce carbon. The x-axis shows the reduction in carbon emissions, while the y-axis shows the COST as a percentage of GDP. Thus a NEGATIVE value on the y-axis represents an INCREASE in GDP, while a POSTIVE value on the y-axis represents a DECREASE in GDP.

Again, it must be noted that economic activity (and thus GDP) WILL be impacted by climate change as some stage, and all of these initiatives will be cost the economy less now than later. The secondary benefits of these initiatives (increased employment, food, energy security, “happiness” etc) also need to be considered.

³² The work done by the ERC lays the foundation for the LTMS.

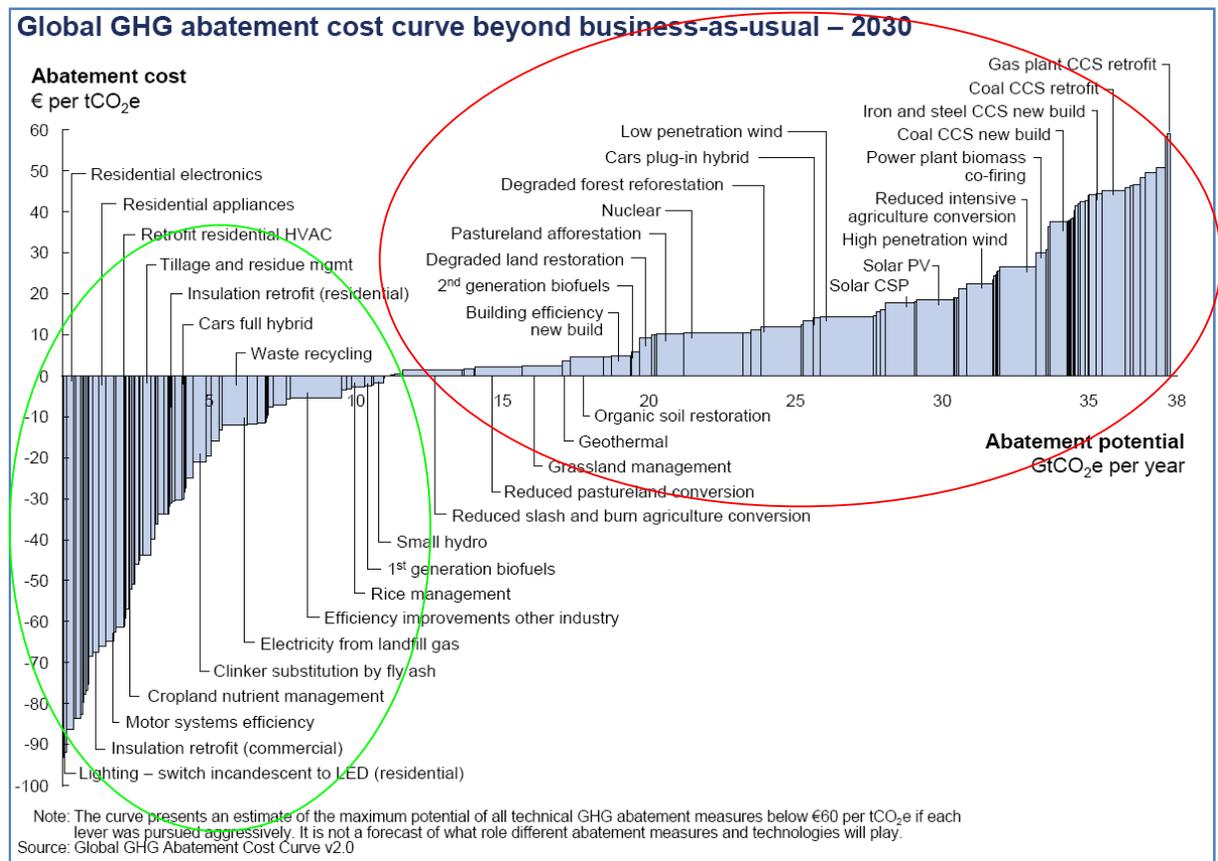


Figure 3: McKinsey Global GHG abatement³³

³³ McKinsey & Co, *Pathways to a low-carbon economy*, 7.

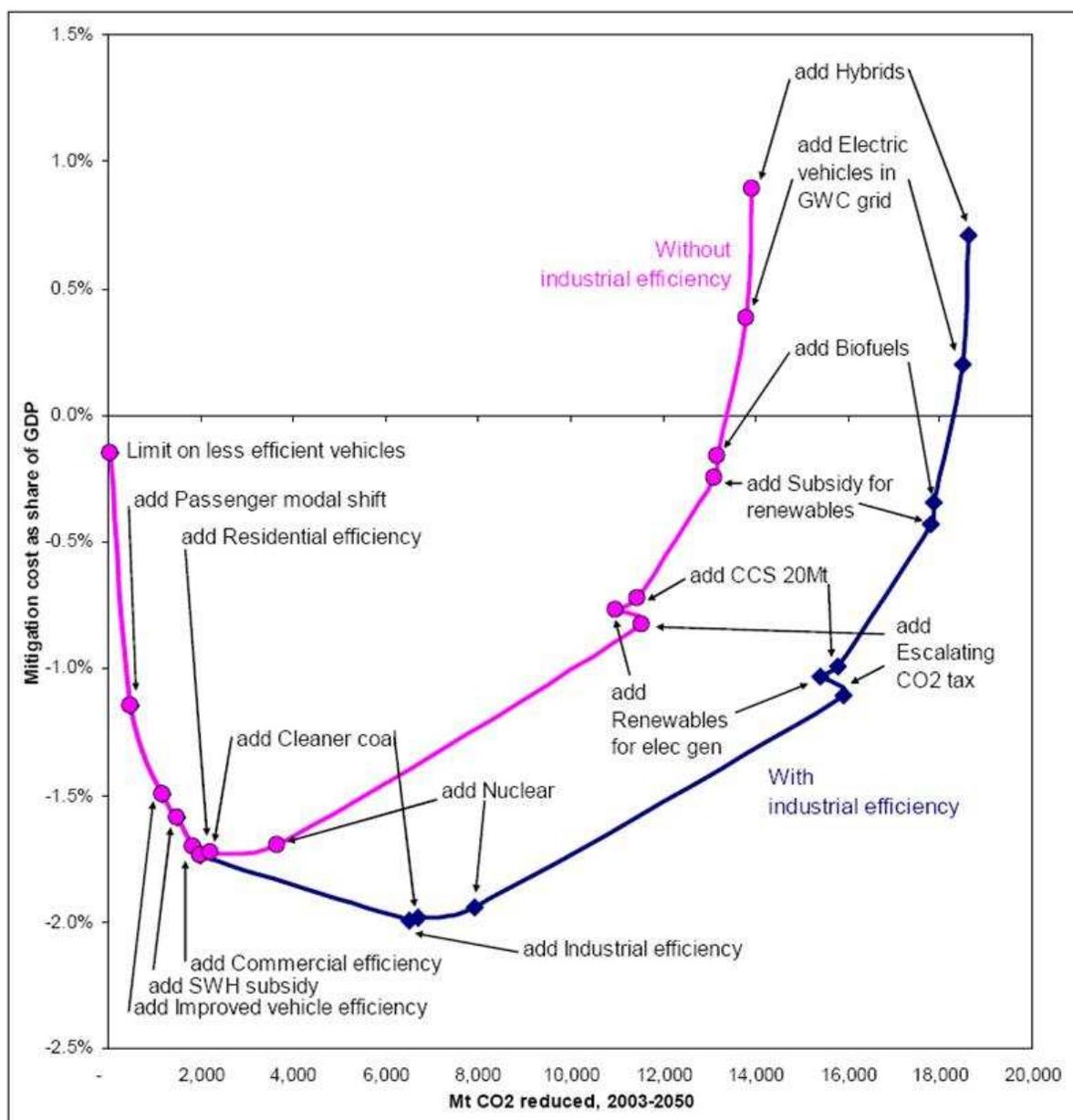


Figure 4: Long Term Mitigation costs as a percentage of GDP.

In April 2006 the National Treasury published for comment a remarkable document entitled *A Framework for Considering Market-Based Instruments to Support Environmental Fiscal Reform in South Africa*. The document defines an **environmental tax** as a “tax on an environmentally-harmful tax base” (Republic of South Africa. National Treasury 2006ii (emphasis in original)) and examines all existing environmental taxes, charges and levies, which combined account for approximately 2% of GDP and just under 10% of total tax revenue. The report suggests that in light of the sustainable development challenge, **tax shifting is required** so that taxes levied on “bads” (such as pollution) can be increased and taxes on “goods” (such as labour) reduced. This, the report argues, is the “**double-dividend hypothesis**” – “minimising the burden of

environmentally-related taxes on the affected sectors, whilst creating the required behavioural incentives to achieve certain environmental outcomes” (Republic of South Africa. National Treasury 2006). **Put differently, taxes from unsustainable practices should increase, and be re-invested in more sustainable practices.**

The LTMS graph above shows that the following green interventions **increase** GDP by about 2% (and increase jobs as well) while reducing carbon emissions by over 6000 MtCO_{2e} by 2050:

- Change Vehicles
 - Limit low efficiency vehicles
 - Improve vehicle efficiency
- Passenger modal shift from cars to mass transportation
- Energy Efficiency
 - Industrial
 - Commercial
 - Residential
- Solar Water Heaters

In addition, the LTMS argues that the following green interventions, when added to the above interventions, lead to a **net zero impact on GDP**, but **significantly increase jobs & reduce carbon emissions** to a cumulative 18000 MtCO_{2e} by 2050:

- CO₂ Tax
- Renewable Energy Electricity Generation
- Subsidy for Renewables
- Biofuels (very small benefit)
- Clean Coal Technology (very small benefit)
- Nuclear (very small benefit)

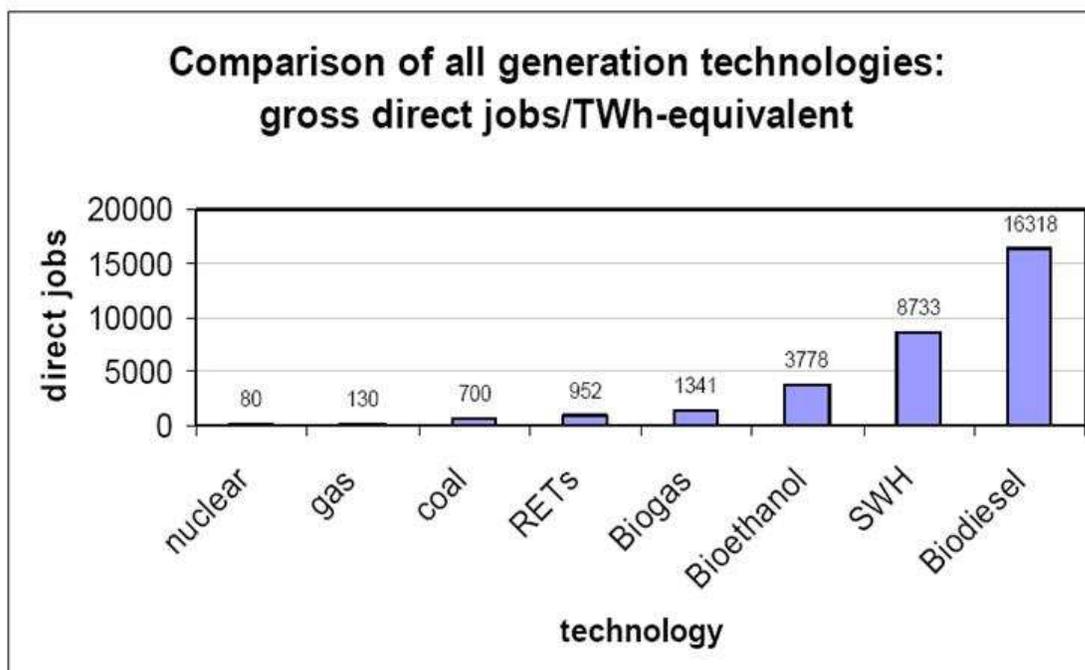
Other research conducted in 2003 showed that³⁴:

- The large-scale deployment of renewable energy technologies **will sustain and substantially boost the number of jobs in the energy sector**, particularly because of the development of local manufacturing industries.
- **Job creation in renewable energy** is only possible when **progressive national deployment targets are set**, due to the attendant manufacturing, installation and O&M capacity that are initiated.
- **Massive employment gains can be achieved quickly and easily** in the SWH and biofuels sectors, while showing good returns on a limited investment by government.
- Renewable Energy Technologies provide **significantly more jobs** than new coal based generation, but require greater investment both in money and skills training.

³⁴ AGAMA Energy, *Employment Potential of Renewable Energy In South Africa*, 17.

Specifically the research found that coal-based generation provides 330 jobs/TWh, gas 130 jobs/TWh and nuclear 80 jobs/TWh, while Solar Water Heating could provide up to 8733 jobs/TWh³⁵.

Other research showed that a South African target of 15% Renewables by 2020 could create 145,000 new jobs in electrical renewable energy technologies and 700,000 jobs in the biofuels space³⁶.



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This Gauteng strategy (see below) indicates that there is indeed opportunity to exploit these opportunities and begin the shift towards a low-carbon economy. **In the process, both food and energy security can be achieved with significant job creation potential in both the low and high skill sectors.**

Kenya plans to launch an open-ended green energy fund in 2010 to step up generation of environmentally friendly energy and conserve energy through the use of energy efficient lighting and appliances. The fund would look to add 2 GW of electricity to the grid by 2012³⁸.

³⁵ Ibid.

³⁶ Global Climate Network, *Low-Carbon Jobs in an Inter-Connected World summary - discussion paper 3, 4.*

³⁷ Sustainable Energy and Climate Change project, *Renewable Energy Technologies*, 2003

³⁸ Reuters, "Kenya plans open-ended green energy fund - government."

4 Measuring Success

A measure of how successful such initiatives are can be done through measuring how “decoupled” the economy becomes from resource use and environmental impacts.

There are four concepts that revolve around the idea of decoupling:

- **Relative decoupling:** whether rates of growth of total resource consumption are lower than economic growth rates (e.g. energy efficient buildings would reduce rate of energy consumption relative to economic growth rates)
- **Absolute decoupling:** whether rates of growth of total resource consumption are negative (e.g. a 15% reduction in water consumption but with growing economic activity would be absolute decoupling)
- **Resource decoupling:** whether rates of growth of resource inputs like water, soils, energy and building materials are declining (in relative or absolute terms)
- **Impact decoupling:** whether rates of growth of impacts like toxification, eutrophication, degrading air quality, solid waste outputs, water pollution are declining (in relative and absolute terms)

These are illustrated in the figure below.

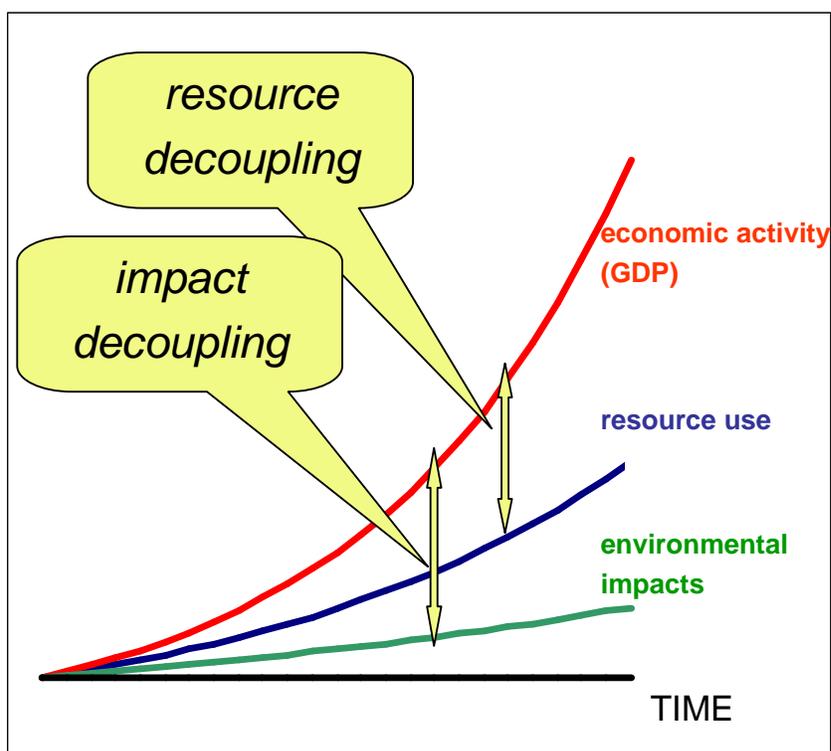


Figure 5: Decoupling

Resource decoupling refers to **decoupling the rate of consumption of (primary) resources from economic activity**, which is equivalent to “dematerialization”. 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, in other words, **an increase in the efficiency** with which resources are used. Resource productivity can usually be measured unequivocally: it can be expressed for a national economy or for an economic sector or even for a certain economic process or production chain **by dividing added value by resource input (e.g. GDP/Domestic Material Consumption)**. If this quotient increases with time, resource productivity is rising. Another way to demonstrate resource decoupling is comparing the gradient of economic output across time with the gradient of resource input: if the latter is smaller, there is resource decoupling.

Impact decoupling, by contrast, refers to **the relation between economic output and (various) environmental impacts**. There are environmental impacts associated with the extraction of resources required (such as groundwater pollution due to mining or agriculture), environmental impacts from production (such as land degradation, wastes and emissions), environmental impacts associated with the use phase of commodities (for example mobility resulting in CO₂ emissions), and there are end-of-pipe environmental impacts (again wastes and emissions). Methodologically, these impacts can be estimated by life cycle analysis (LCA) in combination with various input-output techniques. **If environmental impacts become dissociated from added value in economic terms, there is impact decoupling.** 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.³⁹

Countries such as Germany, China and Japan use such methods to evaluate their sustainability. China in particular is driving this agenda very hard with regulations, incentives for innovation and investments.

Gauteng could consider using a similar methodology to measure the “greenness” of its economy and become the leader in these systems in Africa.

5 Gauteng Macro-Economic Challenges

Some of the key Macro-Economic weaknesses from a “Green” perspective are discussed below. Further information can be found in *Appendix B: Additional Comments on the Economic Crisis and Ecological Limits*.

5.1 Food

Supply of sufficient reasonably priced food is a fundamental underlying requirement for economies to grow. However, the price of food has already been under significant pressure, and this is likely to continue faced with the challenges of:

- Rising oil prices, and thus fertilizer prices;
- Use of arable land for biofuels;

³⁹ 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.

- Degradation of soils due to water erosion and other factors.
- Over-use of soils until they become unproductive.

5.2 Energy

Gauteng is heavily reliant of fossil fuels for energy, and is responsible for about one third of South Africa's energy consumption and carbon emissions. As such, it is a significant consumer of electricity, predominantly from Eskom's coal fired power stations in Mpumalanga. Nevertheless, many industries generate their own energy using coal as a primary energy source. As low-grade coal is used in these operations and in the power stations, Gauteng's carbon emissions load is extremely high.

The combined issues of Peak Oil, supply & delivery issues with electricity on the Gauteng region⁴⁰, and high carbon emissions seriously impact upon energy security and jobs in the region. The price of oil escalated to almost US\$ 150/barrel in 2008⁴¹ and oil scarcity is likely to become a significant issue over the next decade⁴². The coal price has also risen significantly in the last few years. In addition, regions with high carbon emissions & high energy intensity are becoming unattractive for economic investment. The current international trend is to move to low carbon economies where energy consumption is decoupled from growth.

5.3 Water & Sanitation

With an average annual rainfall of 497mm South Africa is a dry country. **More problematic is that 98% of available water resources have already been allocated. This means that 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.

5.4 Waste

Solid Waste quantities are growing faster than the economy of many cities⁴³. The typical daily average of 2 kg/person is 3-4 times that in many European cities. Both the quantity and nature of solid waste differs considerably across the socio-economic spectrum. People in informal settlements generate on average 0,16kg per day, whereas over 2 kg per day is not unusual in affluent areas.

⁴⁰ Such as overloaded transformers

⁴¹ UNEP (March, 2009): Global Green New Deal – A Policy Brief

⁴² Jackson, T. (2009) Prosperity without growth: The transition to a sustainable economy. Sustainable Development Commission, UK pp.122

⁴³ For example, in Cape Town MSW is growing by 7% per annum.

While many countries have moved away from ‘disposal-to-landfill’ as the primary means of solid waste management, in South Africa the large bulk of solid waste is disposed of in landfill sites spread out across the country. The cost of operating these sites is increasing rapidly.

5.5 Poverty & Inequality

According to figures published by the Presidency, South Africa is still faced with significant development challenges largely as a consequence of the legacy left by apartheid⁴⁴. These include:

- High levels of poverty, inequality and unemployment (23.5% in March, 2009)
- Around 24% of households still live in informal settlements or traditional structures
- 8% of people do not have access to potable water
- 23% do not have access to sanitation
- 27% do not have access to electricity (2008 figure)
- Increasing maternal deaths (probably as a consequence of the prevalence of HIV-AIDS – over 10% of the population)
- Adult illiteracy of 25.9% (2007 figure).

⁴⁴ 2009 Development Indicators published by the Presidency

6 Policy Framework for Action

Below is a list of key drivers that promote the development of a Green Economy for Gauteng Province, as well as a list of recommendations for places where policy could be used to re-orientate towards this type of economy.

6.1 Drivers

Policy to enable a Green Economy should revolve around the following core drivers:

- 12) Creation of both new skills and jobs in new green driven industries;
- 13) Promote innovation in existing processes and new technologies;
- 14) Promote both local and foreign investment into Gauteng;
- 15) Decouple growth from resource consumption, especially dependency on fossil fuels;
- 16) Improve efficiency in energy and resource consumption;
- 17) Promote energy security and reduce dependency on crucial imports (e.g. oil);
- 18) Respect ecological limits;
- 19) Design for virtuous circles i.e. cradle-to-cradle economies, reduce-recycle-reuse;
- 20) Promote equity & fairness to both people and the environment;
- 21) Shift energy supply from Centralised Fossil Fuel systems to Decentralised Renewable Energy Systems;
- 22) Create food security and alleviate poverty.

6.2 Recommendations

8) Energy

- a. Enable local government and companies/individuals/schools/public entities to generate their own energy and sell excess into the grid
 - i. Enable a framework for Power Purchase Agreements – those agreements that allow private companies to sell energy to a buyer such as City Power or a private entity.
 - ii. Combined heat and power
- b. Remove subsidies, penalise inefficiency and incentivise low-carbon initiatives
- c. Stringent energy efficiency standards for all sectors
- d. Binding renewable energy targets with strong regulatory certainty
- e. Fast tracked skills training in energy efficiency
- f. Public education programs on energy efficiency and renewable energy
- g. Demand-side management
- h. Upgrading/enforcing of efficiency standards (e.g. building codes and energy efficiency of appliances)

9) Climate Change

- a. Emission reduction targets to keep global warming below 2 degrees C
- b. Local emissions trading system – create an enabling environment to allow companies to voluntarily set carbon emission targets and then buy and sell their carbon emission reductions.

- c. Subsidizing research on climate change impacts in and across specific sectors and individual regions
- d. Funding of research on the effects of climate change and techniques for adaptation within and across industries, sectors and regions

10) Resources

- a. Promote large scale local food production
- b. Ecological accounting system
 - i. Mandatory measurement of consumption of ecological services – water, travel, electricity, CO₂
 - ii. Carbon and energy registries/energy and water Auditing
 - iii. Mandating the use of sustainability impact assessments on the policy and project level and adoption of integrated sustainability assessment for long-term, national development strategy
- c. Public sector green procurement
- d. Promote zero waste systems and products (cradle-to-cradle)
- e. Water management programme
- f. Land use and urban policy changes
- g. Promote local beneficiation of materials for local use – don't export for beneficiation and then import
- h. Strict Mine Opening, Running & Closure Management
- i. Extended producer responsibility
- j. Promote waste management programmes, especially recycling
- k. Waste exchange programmes
- l. Sustainable building materials and systems

11) Transportation

- a. Low carbon transportation systems
 - i. Mass transport
 - ii. Electric vehicles
- b. Remove subsidies for fossil fuel and penalise inefficiency (high fuel consumption)
- c. Long-term strategic shift away from private car use and support for mass transit, public transport, rail, etc.
- d. Work closely with Transnet to significantly improve Spoornet

12) Social

- a. Measure Gross National Happiness
- b. Prioritization of eco-efficiency indicators as measurements for benchmarking development progress
- c. Public awareness raising campaigns about the significance of climate change, resource scarcity and Low Carbon Green Growth
- d. Eco-labelling of products (i.e. carbon footprint)

13) Financial

- a. Green taxation (e.g. carbon and energy taxes, fuel charges, congestion pricing)

- b. Green subsidy reform & incentives
- c. Investment in sustainable infrastructure
- d. Payment for environmental services (PES)
- e. Government-backed financing for new green business initiatives
- f. Promotion of eco-industrial parks and smart growth zones (e.g. zero carbon/zero waste IDZ)

14) Economic

- a. Promote growth through innovation and skills in green technologies
- b. Government funded technical vocational and educational training (TVET) for developing new green skills, especially for small and medium-sized enterprises and in innovation.
- c. Green Growth capacity building for public administrators and policy makers
- d. Government support for the adoption and transfer of environmentally sound technologies (ESTs)
- e. Voluntary and mandatory environmental agreements (between governments and the private sector)
- f. Urban growth boundaries

7 Proposed Initiatives

7.1 Local Food Production

7.1.1 Summary of findings

Recommendation	Job Creation Potential	Costs	Benefits
<i>(1) Urban Agriculture</i>		Investment into basic infrastructure, capacity building and support	Food security, job creation, economic growth, building social and environmental capital, provision of free ecosystem services
Scenario 1	None direct. (Food production for poorest households)		
Scenario 2	387,022 households receive supplementary income		
Scenario 3	444,538 direct jobs created		
<i>(2) Land Reform</i>	28,718 direct jobs created	Investment into basic infrastructure, capacity building and support	Land reform, food security, job creation, economic growth
<i>(3) Regionalising the value chain</i>	High, needs further research work	Facilitated industry dialogue to identify opportunities for regionalisation and increasing efficiencies	Multiplier effect on regional economy, job creation, increased efficiencies, economic growth, promoting sustainable best practice

7.1.2 Introduction

The food system (including food production, distribution and consumption) forms a critical and often undervalued component of the economy. A functional and sustainable food system is one which creates jobs and stimulates the economy whilst ensuring food security for all (a fundamental human need) and not undermining the environmental resource base which sustains life and upon which we depend. Without food, the rest of the economy cannot function. The well-documented impacts of the industrialised and unregulated nature of the modern food system include environmental degradation, climate change, high dependency on fossil fuels, marginalisation of small farmers and high levels of food insecurity linked to unfair global trade. Climate change and environmental degradation will continue to threaten food production whilst urbanisation, population growth and growing challenges of poverty and inequality

further undermine food security. Rising oil prices⁴⁵ are set to steadily increase the price of food (as experienced during the 2008 Food Crisis) and measures should be taken to reduce dependency on imported food produce.

In light of these challenges, it is key that regions should shift towards a focus on food sovereignty⁴⁶ in order to protect the supply of and access to sufficient food for all residents. This in turn promotes job creation and economic development through investment in the regional⁴⁷ food system. “Development led by import-replacement rather than export promotion diversifies, stabilizes, and strengthens the regional economy” (Shuman, 1997:56).

This is not uncomplicated. Since 1994, many interventions have been undertaken nationally, provincially and locally, aimed at encouraging small-scale production of food, goods or services for both consumption and profit; many have failed. We must learn from this well-documented past, and ensure that this intervention is based on a robust appreciation of the risks – and an appropriate selection of the model being used, the agencies involved (government, non-government, etc.), and the extent and duration of support for actors involved. The risk is dependency; the aim is food security, food production and sale, and green jobs.

The key sustainability objectives promoted through a regional food system include (1) community resilience and food security, (2) increasing ecosystem services and environmental capital through sustainable production methods and (3) potential for reduced greenhouse gas emissions through reducing food miles.

7.1.3 Gauteng in Perspective

A review of the Commercial Agriculture Census Data (Statistics South Africa, 2006) in comparison with current national consumption trends⁴⁸ applied to the Gauteng population by age group suggests that Gauteng is currently consuming far more food than it is producing and therefore heavily dependent on imported food produce. Table 1 below indicates that a total of 618,000 tons of food are produced per annum in Gauteng in comparison with 5,193,260 tons of total food consumed. A recent study found that 42% of households in the City of Johannesburg were classified as food insecure (Frayne, Battersby-Lennard, Fincham & Haysom, 2009:01). 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 any region.

⁴⁵ Demand for oil is set to increase by a further 45 percent by 2030 with prices expected to reach \$180 per barrel (IEA, 2008:04).

⁴⁶ Food sovereignty can be defined as “the right of each nation to maintain and develop their own capacity to produce foods that are crucial to national and community food security, respecting cultural diversity and diversity of production methods” (Pimbert, 2008:43).

⁴⁷ For the purposes of this report, the term ‘regional’ refers to Gauteng Province and ‘local’ to municipal areas within Gauteng.

⁴⁸ Derived from the National Food Consumption Report (Nel & Steyn, 2002).

The high levels of food insecurity recorded for the region prompted further investigation to establish the food (and therefore also land) requirements to ensure adequate nutritional consumption for the Gauteng population. The findings are presented in Table 1 below and a comparative analysis of current and nutritional consumption is presented in Figure 1 below. The findings suggest that 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 measures⁴⁹.

“Food price changes have had a measurable impact on poor households in urban areas, increasing food insecurity and contributing to dietary changes which, on their part, may have ripple effects in the food processing industry, affecting employment and incomes. For the period October 2007 to October 2008, food inflation at 16.7% outstripped overall inflation which was 12.1% in South Africa (NAMC, 2008). As an indication of what this means for poor households, it is estimated that for the period April 2007 to October 2008, the poorest households in South Africa would have had to raise their incomes by a minimum of 22% to maintain the same food basket (NAMC, 2008, p14).” (McLachlan, 2009:10)

Table 1: Comparison of current production, current consumption and nutritional consumption

Food Group	Current Production		Current Consumption		Nutritional Consumption	
	Total (tons / year)	Area (ha)	Total (tons / year)	Required (ha)	Total (tons)	Required (ha)
Cereals	247,622	72,768	2,757,205	275,720	2,270,222	227,022
Milk	44,323	3,877	395,908	34,630	1,342,039	117,389
Meat	74,711	91,498	347,427	694,855	124,780	186
Vegetables	85,001	3,294	323,424	16,171	1,688,227	84,411
Vegetable Oils	5,579	4,127	35,768	35,768	197,755	197,755
Roots	45,665	1,656	192,912	7,716	0	0
Fruit	8,841	680	292,376	6,497	1,066,915	23,709
Eggs	97,297	116	56,302	9	126,365	21
Pulses	9,250	3,884	123,118	10,260	197,755	16,480
Nuts	140	50	6,912	1,382	185,334	37,067
Other	0	0	661,908	0	20,377	0
TOTAL	618,430	181,951	5,193,260	1,083,010	7,402,729	704,040

Source: Compiled from Statistics South Africa, 2006; Statistics South Africa, 2007; Nel & Steyn, 2002; Harvard School of Public Health, 2009; University of Michigan Integrative Medicine Clinical Services, 2009; USDA, 2009.

⁴⁹ The population of Gauteng is estimated to be 97 percent urbanised.

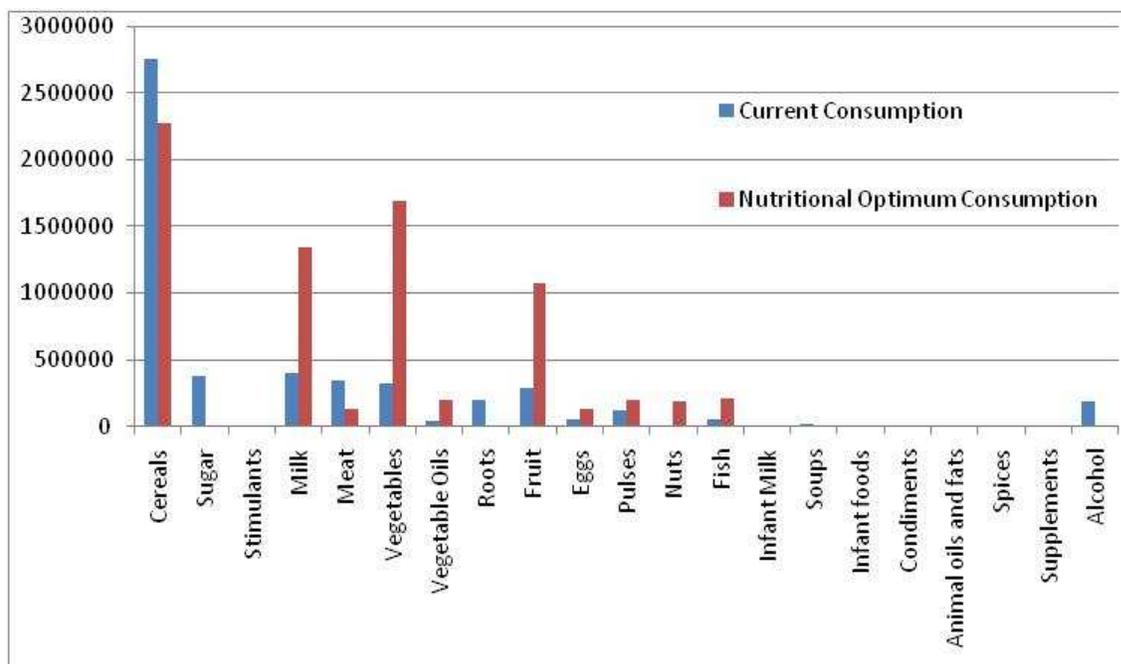


Figure 6: Comparison of current and nutritional consumption

Source: Compiled from Statistics South Africa, 2006; Statistics South Africa, 2007; Nel & Steyn, 2002; Harvard School of Public Health, 2009; University of Michigan Integrative Medicine Clinical Services, 2009; USDA, 2009.

An assessment of current and potential land use was undertaken in order to establish the potential for increasing regional production of food in Gauteng Province to meet demand from the population of Gauteng. Gauteng Province is considered to have the highest percentage of high potential arable land in the country (28.7 percent of total national high potential arable land⁵⁰ falls within Gauteng) and high potential arable land accounts for 28 percent of land area in the province, of which only 3.3 percent falls within the urban edge (Collette, 2008).

Table 2: Current and potential land use in Gauteng

Classification	Area (ha)
Total land area	1,689,079
Land currently under cultivation	181,951
Total high potential (non-urbanised) arable land	293,591
Urban footprint	489,832

Source: Compiled from Statistics South Africa, 2006, Collette, 2008.

⁵⁰ Nationally, only 4 percent of land is considered high potential agricultural land.

7.1.4 Recommendations

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

The recommendations presented below identify opportunities 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; a **strategic land reform programme** for food production aimed through networks of small and diversified farms and building stronger rural-urban synergistic linkages and the **regionalisation and diversification of the food value chain** in order to identify opportunities for increasing efficiencies, promoting sustainability across the sectors and realising new jobs through regional investment.

These objectives align with a number of national and regional objectives, including:

- the Integrated Food Security Strategy (IFSS) which aims to increase household food production and trading;
- improved income generation and job creation opportunities;
- improved nutrition and food safety;
- increased safety nets and food emergency management systems (NDA, 2002).

7.1.4.1 Recommendation 1: Urban Agriculture

Increasing production of key food produce, specifically vegetables, fruit and nuts as well as chicken, fish, milk and eggs through targeting 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.

Recent research shows that only three percent of households in Johannesburg currently grow their own food, but of the small number of residents who do participate in urban agriculture, 31 percent are totally dependent on the food they produce (Rudolph, Kroll, Ruysenaar & Dlamini, 2008). For these households, urban agriculture is currently a coping mechanism and improved institutional support for urban agriculture would dramatically assist these and other food insecure households in accessing food for survival.

The Gauteng Department of Agriculture, Conservation and Environment (GDACE) launched a Homestead Food Security Community Garden Programme in 1996 in response to the identified need for urban food security. The programme targeted vulnerable groups in urban and peri-urban communities and aimed to improve household nutrition and available income. An evaluation of this programme in 2007 showed that the projects have the potential to play an important role in contributing to household food security and supplementing livelihood security but were fraught with institutional challenges and many of the projects initially undertaken were no longer running successfully. Key challenges identified included lack of support

systems to successfully establish the projects and the absence of support systems and exit strategies from the GDACE after the project has been established; not all of the beneficiaries meeting the criteria of 'vulnerable persons'; low beneficiary retention linked to the lag time between start-up and food production and low productivity in the gardens linked to insufficient capacity and support.

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. Key recommendations for government investment to support urban food security from the findings of the Urban Food Security Study in Johannesburg (Rudolph, Kroll, Ruysenaar & Dlamini, 2008) include:

- **Improving supporting infrastructure and urban form:** including local transport networks, central packaging and distribution facilities for small food producers, support for small vendors of fresh producers at strategic urban locations, systems of organic waste recycling and composting, allocation of space for urban food production and retail in spatial planning. Emphasis should be placed on reducing the running costs for food producers and the total environmental impact of food production, including consideration of renewable technologies for water storage systems, use of natural and organic fertilizers and pesticides and efficient localised distribution networks.
- **Enhance economic participation:** implementing safety measures to reduce or prevent sudden food price increases, improve skills development, enhance job placement and Expanded Public Works Programme linkages, support the development of multiple livelihood strategies and protect consumers from price-fixing, corporate collusion and speculation. Further measures should include providing access to micro-finance schemes, investment capital for cooperatives and other mutual aid strategies. Experience from the private sector in supporting emerging farmer's access markets should be learnt from and adopted.
- **Enhance communication, social capital and social mobilisation:** encourage interdepartmental government collaborations, engage in social conscientisation and mobilisation around food security, employ appropriate and powerful media to improve public awareness and enhance mobilisation, collectivise and socialise (e.g., in community food kitchens, community gardens) the production, processing and consumption of healthy foods to develop greater social capital.
- **Improve food availability and accessibility:** enhance urban food production / urban agriculture training and research centres; support the development of more resource-efficient, sustainable and resilient agricultural practices; enhance and support the informal economy; create linkages between local producers and markets; develop food aid programmes and community kitchens accessible to the most vulnerable (elderly, grant recipients) as well as the wider community; engage in public-relation campaigns that inform people about opportunities and procedures for accessing social services and food aid; encourage the formation of food cooperatives and mutual aid strategies.
- **Improve food utilisation:** enhance the public image of health food culture with a focus on diversity; develop more effective nutritional education programmes integrated with the empowerment of informal vendors, community food kitchens and feeding schemes; develop health promotion

programmes; provide households affected by illness and disabilities with additional support (such as food packages, food coupons, job training and placement); regulate fast-food chain and consumer brands to adhere to healthy and ethical nutritional business practices; promote research into food security and poverty eradication; provide training to improve inter-sectoral collaboration between stakeholder groups

The food system is an incredibly dynamic and complex system that cannot easily be simplified. Job creation potential from urban agriculture can be estimated based on land availability and demand for fresh produce is outlined below, but will require in depth research at a municipal level to calculate the specific conditions and opportunities for urban agriculture in each context. Food production without a corresponding market for the produce and extensive support in various forms that goes beyond policy commitments will not realise jobs or food security, and this is perhaps why urban agriculture (and land reform) continue to fail in so many regions. As outlined above, urban food production is critical and has tremendous potential to address to promote both food and livelihood security. Increasing food prices, growing food insecurity and the pressures of urbanisation are strong drivers for urban agriculture going forward and further investigation into a viable and realistic urban agriculture programme based on empirical research and detailed budgeting should be considered a priority for the region.

Calculating the total investment required from government to realise a food secure Gauteng will rest on this research which will give a clearer indication of the types of infrastructural arrangements that need to be considered and what forms of capacity building and ongoing supported could be implemented, but none of this can be detailed in numbers without extensive on the ground research as each situation and set of requirements varies so greatly from community to community.

Abalimi Bezekhaya, an established urban agriculture NGO in Cape Town, has documented that 250 to 500m² of urban wasteland converted into organic food gardens can sustain one job providing an income of R1500 per month (after costs) for produce sold at street prices. They have also recorded that a garden of 100m² has the capacity to provide all the fresh produce needs for a household of 5 to 6 members all year round (Small, 2005).

The findings of the 2007 Community Survey recorded the annual household income distributions, indicating that 1,030,872 households (of a total 2,667,231 households) survive off less than R19,200 per annum (or R1,600 per month). Based on the population distribution by annual household income, three scenarios for urban agriculture in Gauteng are present below.

The first is based on small plot production for household consumption that would contribute to household food security and increasing the disposable income of the households in Gauteng earning less than R19,200 per annum. The second scenario is based on slightly medium plots that would contribute to household food and an additional income generation opportunity for households earning less than R4,800 per annum. The third scenario is based total demand for fresh produce from the Gauteng population translated into job creation potential through larger plot production.

The allotments described here range in size from 100m² up to 600m² which can be sourced from a variety of spaces, including but not limited to backyards, school grounds, church and community centre grounds, rooftops and parks as well as publicly owned land and underutilised land in residential areas. Green corridors can also be established as food producing zones through the planting of fruit and nut trees. A large movement is underway converting residential gardens in wealthier suburbs into 'kitchen gardens' and presents an interesting opportunity for job creation.

Further investigation is required into the availability of land potentially suitable for urban agriculture in Gauteng and a core recommendation is the establishment of a central coordinating agency to undertake the investigation and implementation of a comprehensive urban agriculture strategy. Each of the scenarios below should be phased, targeting vulnerable groups and easily accessible underutilised land first. These scenarios present estimations of the potential to contribute to food and livelihood security at a household level through an urban agriculture programme. A more likely scenario would be a combination of the approaches presented below and a spatial plan for urban agriculture in Gauteng would unfold at a municipal level based on available land, the needs of the communities and the supporting systems in place. Further opportunities for food production and higher revenue returns should be investigated, such as light livestock for eggs, meat and dairy production.

Scenario 1: Household Food Security for Households <R19200 per annum

1,030,872 households cultivate 100m² per household, thereby reducing expenditure on fresh food produce by an estimated R50 per household per month. An additional R51,543,600 becomes available per month as income to be spent on other items and all households earning less than R19,200 per annum have access to affordable fresh food produce (fruit and vegetables).

Land requirements: 10,308 hectares total (in 100m² allotments)
Jobs created: None directly

Scenario 2: Household Food and Improved Livelihood Security for Households <R4800 per annum (small plots)

387,022 households cultivate 300m² per household, thereby reducing expenditure on fresh food produce by an estimated R50 per household per month from the 100m² for household food production and generating an income of R600 per household from the additional 200m²

An additional R19,351,100 becomes available per month as income to be spent on other items, and all households earning less than R4,800 per annum have access to affordable fresh food produce (fruit and vegetables) plus additional production of food for sale to remaining households earning less than R19,200 per month.

Land requirements: 11,610 hectares total (in 300 m² allotments)
Jobs created: 387,022 households earn additional R600 per month

Scenario 3: Household Food and Livelihood Security for Households <R19200 per annum (larger plots)

To meet the basic fresh produce requirements of the population of Gauteng, 26,672 hectares need to be cultivated which can be done by 444,538 people on 600m² plots.

- 100m² to meet the needs of their own households, thereby saving R50 minimum per month and freeing up a total of R22,226,925 per month.
- 500m² to grow fresh produce for sale, enough to feed a further five households per plot with nutritious and affordable food, and generate a monthly income of R1500 per grower. Total of R666,807,000 income generated per month and all households in Gauteng have access to affordable fresh food produce (fruit and vegetables).

Land requirements: 26,672 hectares total (in 600 m² allotments)
Jobs created: 444,538 direct jobs

Further investigation into the actual availability of land for urban agriculture and market demand for fresh produce in Gauteng when coupled with government intervention strategies to promote food security would provide a clearer indication of the viability of this estimation.

Job creation potential: 444,538 jobs

7.1.4.2 Recommendation 2: Land Reform & Improved Market Access

Land reform to increase regional production in rural and peri-urban areas would also serve to 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. "As the economy became more local, local farming would become more diverse; the farms would become smaller, more complex in structure, more productive" (Berry, 1993:25-26). Diversification is associated with production for regionally orientated

markets and reducing risk of individual crop failures (Altieri, 2002b:xii-xiii). Diversified farms are typically more productive per square meter (Rosset, 1999), and tend towards agroecological and sustainable methods of production (Pretty, 1998:197-198). Networks of smaller, diversified farms are well suited to regional demand for food and fit the models better suited for land reform initiatives which are a key national objective for rural development.

Land reform has the potential to create jobs, promote rural development and ensure food security for the province of 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. Furthermore, “investments in infrastructure and facilitating access to markets and trade opportunities, occupational education and extension services, capital, credit, insurance and in natural resources such as land and water” are critical (IAASTD, 2008:11). Further investigation is required into the investment required to cover land and infrastructure costs as well as ongoing capacity and support. Given the complex and context specific nature of food production, broad estimates cannot be made without further investigation.

Key recommendations are put forward to assist small producers in leveraging support structures, accessing markets and developing the required skills development that are currently lacking in most land reform programmes:

- **The cooperative model** has proved successful in many countries for small-scale and emerging farmers to pool together resources and share support but requires support in the form of building management capacity.
- Other options that should be considered include **micro-finance schemes** and building on the success that the private sector has had in building **private sector partnerships with emerging small-scale farmers** for the supply of a variety of fresh and processed food products.
- **Centralised packaging and transport nodes** should be invested in as public serving infrastructure to assist emerging farmers in getting their produce to market.
- These could be coupled with **learning centres** to build new systems of agricultural skills and knowledge.
- **Targeted skills development programmes** for emerging farmers on agroecological⁵¹ methods (thereby reducing dependency on fossil fuels and building resilience to climate change), marketing skills (to local markets) and business management are critical, and should be invested in for the development and security of both the farmers and the wider community (Pretty, 2001:11).

Calculating the job creation potential below is based on availability of high potential arable land in the region and at commercial agricultural productivity and employment ratios. Further investigation is warranted into the actual land availability, land values and productivity from site to site based on climate, soils and water availability, as well as feasibility studies regarding access to land, ownership, and related matters. The introduction of sustainable production methods that build the integrity of the soils and reduce

⁵¹ Agroecological refers to agricultural systems which are assessed and valued from an ecological and socio-economic perspective; and promote ecological relationships in agriculture in order to develop healthy and sustainable systems of agricultural production (Goering *et al*, 2001:62; Pretty, 2002:viii).

dependency on high external outputs (such as fossil fuel based fertilizers and chemicals) will not only contribute to the environmental capital of the region but also increase the resilience of the farmers through a reduced dependency on increasingly expensive farm inputs.

Total high potential arable land	293,591 hectares
Food production on arable land at 4 tonnes of food per hectare ⁵² :	1,174,364 tonnes
Job creation potential at 1 job per 20 tonnes of food produced ⁵³ :	58 718 jobs
	<i>less 30 000 existing jobs</i>
	= 28 718 jobs

Current agricultural practice in Gauteng (contributing a total of 30 000 jobs to the region) are not all situated on high potential arable land. The 30 000 jobs created from agriculture have been subtracted from the potential job creation figure of 58 718 jobs but given that the land areas of currently farmed land and potentially arable land do not correspond, the job creation potential may be larger than the 28 718 jobs identified above.

Job creation potential: 28 718 new jobs

7.1.4.3 Recommendation 3: Value Chain Regionalisation & Diversification

Increasing agricultural production is key to achieving food security but must be coupled with “broader, more systemic interventions in the value chains linking the production, manufacturing and retail of food. The private sector faces a compelling business case to resolve the food security situation, including risks of economic stagnation, social unrest, trade restrictions and impacts on reputation and brand value” (McLachlan, 2009). **Value chain regionalisation and diversification** presents an opportunity for promoting food security through key interventions, but also job creation and economic growth through the development of the entire regional food industry. A key component of building a strong regional food economy is the **localisation of the entire value chain**, from seed and compost production through to value adding and beneficiation, thereby introducing various system efficiencies and stimulating the regional economy further. The circulation of resources within the regional context is therefore both the food itself and the nutrients used in the production of the food as well as payment for the food.

There are several opportunities for stimulating the regional economy beyond supporting regional food growers (who typically benefit from receiving a greater share of the food dollar and contribute to the regional economy when encouraged to spend their income on regional produce). Different local food

⁵² Conservative estimates of food production capacity through diversified production of vegetable, fruits, nuts and grains as well as livestock at commercial production rates.

⁵³ Conservative ratio of 1 job per 5 hectares at commercial agriculture standards. Whilst Intense organic vegetable and other field crop production on diversified farms have recorded ratios of 1 job per 1 hectare a standard ratio of 20 tonnes = 1 job has been applied consistent to both commercial and diversified small-scale farms (i.e., small organic farms are more productive per hectare but generate similar levels of job creation per tonne of produce).

economy initiatives such as **Community Supported Agriculture (CSAs), local markets and consumer cooperatives** are critical in supporting regionally grown produce in reaching consumers more directly and effectively. A **local distribution hub for regionally produced foods** should be established to assist both farmers and consumers in connecting more directly and maximising the benefits of central coordination. **Livelihood security** of the wider community can be promoted with the production of farm inputs and micro-enterprises, supporting regional distribution through to value adding industries associated with the food sector (Shuman, 1997:53). **Processing and packaging enterprises** that have previously been located elsewhere can be established in local food sheds, thereby stimulating regional enterprises further (Shuman, 1997:52). “Locally and regionally produced food offers greater security, as well as synergistic linkages to promote local economic development” (Rosset, 2002:xix).

The multiplier effect of localising the food system both stimulates the regional economy and builds resilience. A recent study by Sonntag (2008) found that “locally directed spending by consumers more than doubles the number of dollars circulating among businesses in the community” (Sonntag, 2008:v). Research by Ward and Lewis (2002:20) found that for every £10 pounds spent with a local producer through an organic box scheme, the money was circulated within the local economy to make a total contribution of £25 to the local economy (in comparison with a worth of £14 to the local economy if spent at a local supermarket). In this way, money spent on locally or regionally produced food generates twice as much income for the local economy (New Economics Foundation, 2001) and promotes stronger social cohesion for the entire community (Taylor, Madrick & Collin, 2005:01).

Local economies tend to address inequalities of wealth by spreading their gains evenly through the entire community whereby “improving the economic welfare of farmers, farm workers, small producers and shopkeepers benefits entire local economies, providing in turn deep social benefits to communities as a whole” (Norberg-Hodge, Merrifield & Gorelick, 2002:31). A study by Goldschmidt in the 1940s of two similar sized towns in rural California found that the town surrounded by small family farms supported twice as many businesses and generated more than 60 percent retail volume than the industrial farm town, including a range of secondary industries and supporting community enterprises (Norberg-Hodge, Merrifield & Gorelick, 2002:31). “Local economic development therefore can provide an effective counterforce against economic, political and social vulnerability due to the forces of global competition” (Marsden & Smith, 2005:442).

Building **strong regional food systems** create opportunities for job creation on a larger scale than one person per plot as outlined for food production through diversification and growth into sectors such as manufacturing, distribution and retail. **Networks** of small and diversified producers, manufacturers and retailers are key to realising a vibrant regional food economy with strong multiplier effects. Key interventions are highlighted in the policy recommendations in the section below and include a strong focus on **assisting small farmers, small manufacturers and small retail outlets in competing with the growing concentration power sitting in the retail sector of the food value chain** (McLachlan, 2009). Dialogue needs to be facilitated across the food industry value chain to identify opportunities for building a stronger regional food economy and opening opportunities for small producers to enter the market. The

Sustainable Food Lab (<http://www.sustainablefoodlab.org/>) has had success with facilitating similar initiatives in other countries with outcomes such as increasing efficiencies and profits as well as overall sustainability in the sector being stated, though no documented impacts on job creation in specific have been recorded.

According to the 2005/2006 Income and Expenditure Survey, Gauteng residents spend an average of R8,486 per annum of food per household. At a total of 2 967 693 households, this amounts to R251,838,842,798 per annum spent on food from the Gauteng region.

Breaking this down further for fresh fruit (R262 per household per annum) and vegetables (R808 per household per annum) alone, this amounts to over R3 billion in total expenditure per annum on produce that could be sourced from within the province and mostly even within the urban zones. Thus a multiplier effect of 2.5 would have a total contribution of over R7 billion to the regional economy of Gauteng if the focus of fruit and vegetable production were directed towards networks of small and diversified food producers and distributors.

Job creation potential: **High, requires further research**

7.1.5 Summary of Policy Recommendations

McLachlan (2009:40-42) summarises the following key policy recommendations 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 Africa food system:

“With regard to urban food security, the following issues require priority attention:

- **Ensuring access to social grants for all eligible households:** Measures should be taken to strengthen local capacity at all levels to improve the take-up rate of grants. In addition, direct food grants, food production for own use or for sale, and support to community service organizations to provide food-related services should be considered.
- **Implementing measures to improve dietary diversity, food safety and food quality:** Education on dietary and life-style choices at schools and in the community deserves more attention, as do measures to limit advertising of non-nutritious food to children. The quality and safety of foods provided through vendors and informal shops, should be improved through education and incentives. Improving infrastructure, particularly in informal settlements, can contribute significantly to improving health, and should therefore continue to be a priority.
- **Implementing a provincial urban agriculture policy, and incorporating food security into integrated development plans:** Local municipalities should be assisted to incorporate food security into local planning processes, within the framework of a national urban agriculture and food security policy.
- **Strengthening and supporting the role of the private sector in food security initiatives:** The role of the private sector in developing a bridge between the formal market system and food aid activities also deserves more attention.”

- Furthermore, focussing on opportunities for small food producers, manufacturers, distributors and retailers to access the market, including **value chain wide facilitated dialogue** to indentify blockages and opportunities for job creation. 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.

McLachlan (2009:40-42) further identifies “with regard to agriculture and the food system, the following issues require priority attention:

- **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. This will include assistance in accessing commercial supply chains, which currently favour large-scale farmers. Such assistance should include support for collective action, as well as support for access to alternative markets where commercial processors and supermarkets play a less prominent role.
- **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 diligent **application of competition policy** along the supply chain, as has been accomplished over the past few years.
- 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

With regard to institutional arrangements, leadership and capacity to address food security, the following issues require priority attention.

- Focusing on **strengthening local municipalities** in rural and urban areas to develop and implement food security strategies, including measures to address food emergencies, and collaborative strategies to harmonize the efforts of the public and private sector and civil society.
- At all levels, developing a cadre of outstanding **food security leaders**, by implementing a management and leadership development programme for the sector, in collaboration with leading management and leadership institutions in the country.”

Key sustainability policies need to be incorporated into the food system, including **reducing dependency on non-renewable** (and increasingly expensive) resources, **minimisation of environmental degradation** to avoid impacting on the provision of key life-sustaining eco-system services and **addressing challenges of poverty and inequality** through positive development and building of social and environmental capital as well as realising economic growth and development.

To achieve this level of food production and security, the DED will need to lobby others to work with them, especially the Depts. of Agriculture, Social Development, and Land.

The large scale job creation programme could be run through Community Driven Development and a Community Employment Programme i.e. job creation and training under a public works programme guise.

Note: The linkages with water have not been explored. This needs to be done in a further study.

7.1.6 References

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7.2 Solar Water Heating

7.2.1 Summary of findings

Based on the proposed Gauteng 2025 target of 95% penetration into mid- to high-income houses and 50% into low-income houses, the following projections can be made:

Total no of high-income sector systems to be installed	1,266 thousand
Total cost to consumers to install all high-income sector systems (discounted (10%) to 2009 Rand for later installations)[1]	R 6,693 million
Total electricity saved per year when all high-income sector systems installed	2,413 GWh
Estimate of annual electricity bill savings per high-income household per year ⁵⁴	R 1,143
Carbon emissions averted per year when all high-income sector systems installed (metric ton)	2,109,635 tons
Total no of low income sector systems to be installed	666 thousand
Total cost to install low-income sector systems (discounted (10%) to 2009 Rand for later installations)	R 1,189 million
Total electricity saved per year when all low-income sector systems installed	543 GWh
Estimate of annual electricity bill savings per household per year ⁵⁵	R 651
Carbon emissions averted per year when all low-income sector systems installed (metric ton)	712,215 tons
Carbon Credit revenue per year when all low income sector systems installed (discounted (10%) to 2009 Rand) (mil Rand)	R 11.7 million
Total jobs created to achieve all high and low income installation targets with maximum local content	6,707

7.2.2 Introduction

Solar Water Heaters (SWH) can effectively replace conventional electrical geysers, electrical kettles and other water heating methods used to provide hot water for household cleaning and personal hygiene in both high and low income homes. By supplanting these devices, SWHs **reduce the demand for electricity** generated in coal-fired power stations and **creates many more jobs** than conventional power generating means. This in turn **reduces the emission of harmful pollutants** into the environment and mitigates against **the electricity shortage crisis** in South Africa by reducing peak demand. On the consumption side solar water heaters **save households money** on their electricity bills and in low-income homes they **offer readily available hot water where it was previously only available after time-consuming heating processes**.

Though it is still relatively small in terms of output the SWH industry in South Africa is well established⁵⁶ and with government support in terms of policy and subsidies could be scaled up to **provide thousands of**

⁵⁴ 2009 CoJ tariffs

⁵⁵ *ibid*

jobs, especially to **semi-skilled workers** who generally struggle to find employment opportunities. Unfortunately the up-front costs of installing a solar water heater remains too high for most households, especially in the low-income bracket, even though the life cycle costs of SWH are less than that of conventional heating means. Government support is necessary to ensure that the technology is successfully rolled out and creates the maximum amount of employment opportunities.

By integrating environmental and developmental concerns to achieve the fulfilment of human needs solar water heating presents a key entry point for the development of a green economy in Gauteng.

SWH offers Government the opportunity to achieve its electrification targets with much smaller increases in electricity supply required as they supplant 30-40% of electricity required in low-income households. There is also a moral and political imperative to ensure that a SWH initiative does not exclude low-income communities and worsen inequality in the Gauteng province. In high-income groups SWH offers long-term savings and environmental benefits without contributing to quality of life, in low-income communities similar benefits are achieved whilst quality of life is also drastically improved. The technology provides an opportunity for socio-economic upliftment that cannot be ignored.

7.2.3 Installation Targets

Gauteng's proposed 2025 SWH targets⁵⁷ are as follows:

95% of mid to high income households (based on 0.8% population growth) ⁵⁸	1 266 393 systems installed
50% of low income households (based on 0.8% population growth) ⁵⁹	666 522 systems installed

It is estimated that less than 0.1% of Gauteng residents currently use a Solar Water Heater⁶⁰.

Though the argument for SWH makes more sense for high-income consumers from an environmental and economic perspective, it is imperative that the low-income market sector should be included in a rollout strategy. SWHs offer an important developmental service that can improve the quality of life of poor households without harming the environment. Politically it is critical to demonstrate that renewable energy technologies do not just offer benefits to the rich but that they can be a powerful agent to reduce inequality in society.

The insurance industry are the largest procurers of electric geysers (I think it is 250 000). The author is aware that both Santam and Hollard have initiated studies to determine how they can use this leverage to increase supply of SWH. There are the multiple benefits for them to do this, including:

- Reduces their risk (i.e. the geyser is on the roof, not underneath),

⁵⁶ SWHs have been commercially available in South Africa since the 1970s

⁵⁷ Dept of Local Gov & Housing, *Gauteng Integrated Energy Strategy*.

⁵⁸ City of Johannesburg, *Spatial Development Framework 2007*

⁵⁹ 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.

⁶⁰ GCRO Survey undertaken 2009

- Reduces insurance premiums for households
- There are carbon emission benefits to be earned from a large roll-out programme.

7.2.4 Installation Requirements and savings

The following table shows the recommended baseline requirements and costs for SWH installations in low and middle-to-high income households:

	Mid to high income household	Low income household
Collector type	Flat plate ⁶¹	Flat plate
Recommended minimum collector area	2.3m ²	1.5 m ²
Geyser and collector coupling	Indirect ⁶² . Close coupled thermosyphon or separated active system	Indirect. Close coupled thermosyphon system
Pressurised system	Yes	No
Electrical back-up	Yes	No
Benchmark cost	R15 000 ⁶³	R5000 evacuated tube/ R8000 flat-plate collector ⁶⁴

The following table shows the electrical energy that could be saved through SWH:

	High income households	Low income households
Conservative estimate of average electricity consumption per year⁶⁵	2722 kWh	1164 kWh
Typical savings with SWH	70% ⁶⁶	90% ⁶⁷
Projected annual electricity savings	1905.4 kWh	814.8 kWh
Projected annual electricity bill savings⁶⁸	R 1143.24	R 651.84
Total annual electricity savings in Gauteng if installation targets achieved	2413 GWh	543.08 GWh

⁶¹ Evacuated-tube systems have been excluded due to the fact that in the Gauteng climate they can easily boil the water creating a health hazard and shortening the life of the SWH.

⁶² Indirect systems are systems that include a form of heat exchanger so that they collector panel can be used with anti-freeze (glycol) to prevent freezing in the cold winter periods.

⁶³ Based on prices supplied on the Eskom List of SABS approved Solar water heating suppliers available at http://www.eskomdsm.co.za/?q=swh_supplierslist

⁶⁴ Based on prices for the City of Cape Town Kuyasa project in Cape Town and the Western Cape SWH programme as well as industry price reductions at scale.

⁶⁵ Agama Energy, *Baseline Study Solar Energy in South Africa*

⁶⁶ Holm 2005, *Market Survey of Solar Water Heating in South Africa*, Agama Energy, *Baseline Study Solar Energy in South Africa*

⁶⁷ Based on interviews with low-income households that have had SWHs installed in Kuyasa and Stellenbosch

⁶⁸ At an electricity tariff of around R0.60 per kWh for mid and high income households as will be charged in the City of Johannesburg in 2010 for metered customers on life line conventional or on average for three part seasonal tariff customers and R0.80/kWh for low-income households with prepaid electricity, City of Johannesburg *Schedule of Tariffs For 2009/10*

The energy saved is comparable to that which a small power station of 300 MW would produce. These electricity savings are particularly valuable as a significant part thereof would occur in peak electricity demand periods when the national electricity supply is shortest and electricity generation most expensive at up to R2.50/kWh for gas/diesel power generation. During this time, residential use accounts for up to 30% of electricity demand⁶⁹. The savings would reduce residential electricity demand by roughly 18%, more than enough to achieve the targets set by the Energy Efficiency Strategy of 2005.

The following table shows the pollution that could be averted by the use of SWH:

Pollution generated in SA during power generation from coal-fired power plants				
	NO _x	SO _x	PM10	CO ₂
mg/kWh	4020	8970	390	960000
Metric Tonnes of Pollution averted if 2766.52 GWh electricity saved	11 883	26 516	1 153	2 837 825

70

7.2.5 Economic Payback Period

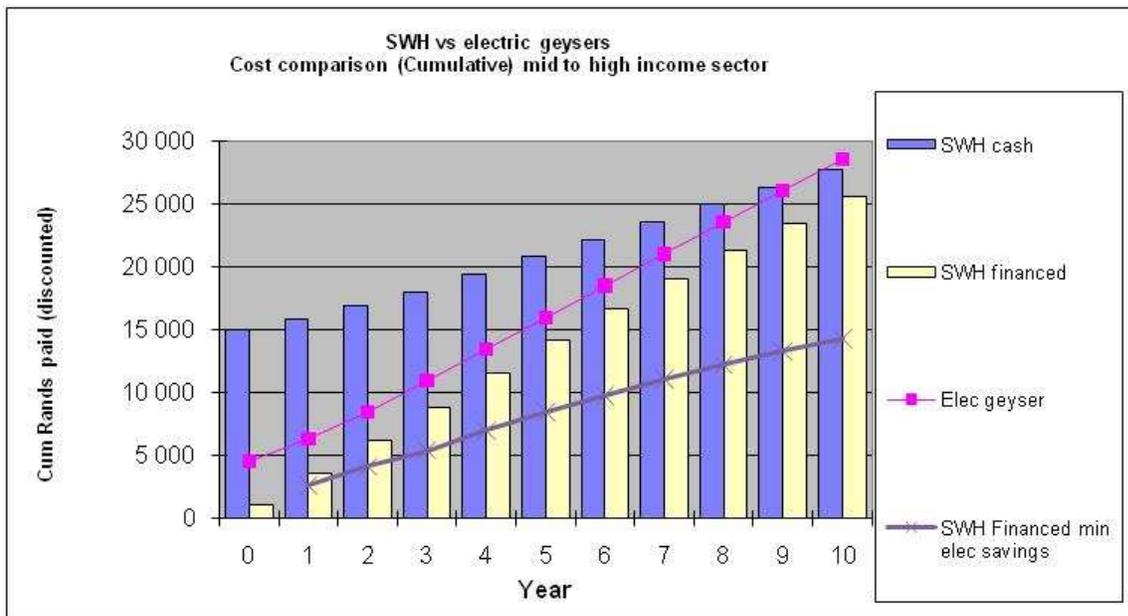
The table below shows the modelling used to calculate the economic payback.

ASSUMPTION TABLE	Mid-high income sector installations	Low income sector installations
Elec geyser cost (incl install)	R4500	R4500
Elec geyser cost/month	R150	R60
SWH cost (incl install)	R15 000	R8000
SWH elec cost/month	R70	R0
Finance rate	11%	11%
Financed over (years)	20	20
Elec Inflation Rate (Years 1-3)	30%	30%
Elec Inflation Rate (Years 4-20)	10%	10%
Discount rate	10%	10%

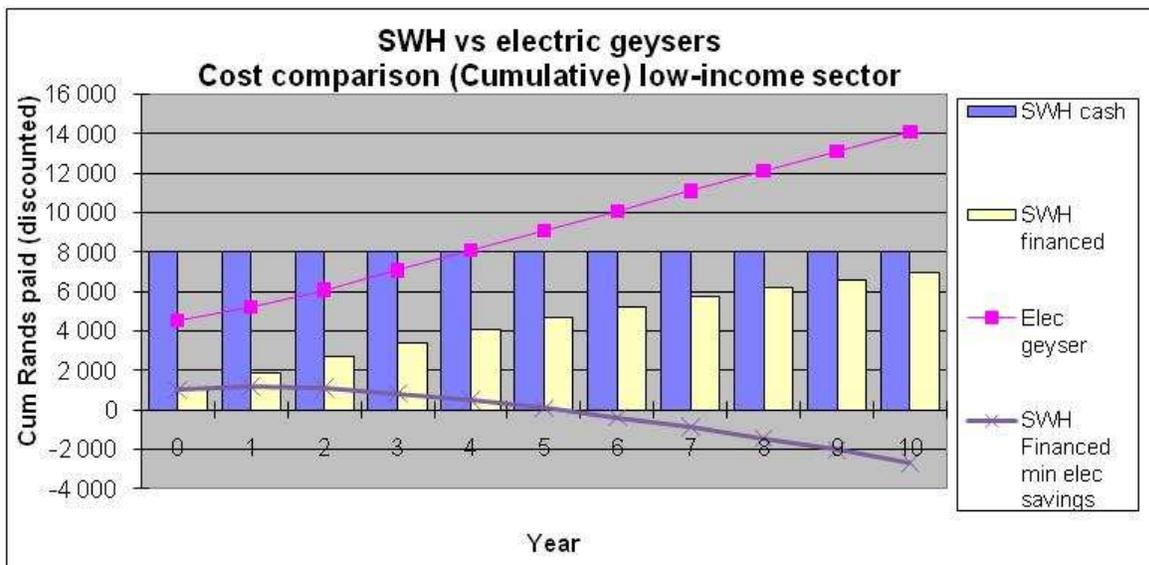
69 Eskom, 2009. *Residential Load Management FAQ*.

70 Von Blottnitz, *A comparison of air emissions of thermal power plants in South Africa and 15 European countries*

The graphs below show that a financed Solar Water Heater is cheaper than an electric geyser for both high and low-income households.



71



7.2.6 Job Creation Potential

⁷¹ Based on a original model developed by Andrew Janisch, Sustainable Energy Africa and with input from Frank Spencer, G-tech energy.

The SWH industry can provide 15 jobs/MW_{th} of installed nominal capacity for locally manufactured systems and 8 jobs/MW_{th} of installed nominal capacity for imported systems⁷². The nominal capacity of SWHs in South Africa is taken as⁷³ 0.7 kW_{th}/m². In his *Market Survey of Solar Water Heating in South Africa* Holm finds that the **SWH industry can potentially grow at 26% per annum.**

Based on these assumptions supporting **the development of the SWH industry in Gauteng has the potential to create up to 6700 jobs if the largest possible portion of systems is sourced locally.** Refer to the table at the end of this section for a proposed rollout strategy that would maximise the number of jobs created whilst still achieving the rollout targets. In terms of creating a green economy and achieving maximum economic potential it is essential that the local industry be supported as imported systems create almost 50% less direct jobs. With sustained government support local production costs can be expected to fall by 20-30% for each doubling of output⁷⁴ and the industry **could eventually become a major export industry catering primarily for the low-income market in Southern Africa.** As local production capacity and the domestic and export markets grow the industry could generate valuable revenue for Gauteng province and create more jobs.

7.2.7 Potential of Carbon Financing

The sale of avoided CO₂ emissions through Certified Emission Reduction Certificates (CERs) provides a potential additional source of funding for SWH rollout programmes in the low-income sector. Due to uncertainty after the Copenhagen climate change conference the price of CER credits has fallen to around €8/tonne⁷⁵ of CO₂ on European markets. The table below provides a breakdown of the possible discounted value of income that could be received from the sale of carbon credits through a SWH initiative in low-income communities.

Potential carbon credit revenue from low-income sector installations								
Year	2010	2011	2012	2013	2014	2015	2016	2017
Cumulative nr of Installations	0	13333	28400	45651	65653	88775	109947	136624
MWh of electricity saved per annum	0	10864	23140	37196	53494	72334	89585	111321
Potential carbon credit revenue discounted (mil Rand) ⁷⁶	R 0.0	R 0.9	R 1.7	R 2.5	R 3.3	R 4.0	R 4.5	R 5.1
Year	2018	2019	2020	2021	2022	2023	2024	2025
Cumulative nr of Installations	170236	212588	265952	333190	416523	499856	583190	666523

⁷² Based on data provided by Agama Energy, *Employment Potential of Renewable Energy In South Africa*

⁷³ Figure provided by The European Solar Thermal Industry Federation (ESTIF) and the IEA SHC Programme in Holm, *Market Survey of Solar Water Heating in South Africa*

⁷⁴ Holm, *Market Survey of Solar Water Heating in South Africa*

Carbon Positive, *Carbon markets 2010: Modest hopes for recovery*

⁷⁶ Based on an exchange rate of R11/€1

MWh of electricity saved per annum	138709	173217	216697	271483	339383	407283	475183	543083
Potential carbon credit revenue discounted (mil Rand)	R 5.8	R 6.6	R 7.5	R 8.5	R 9.7	R 10.6	R 11.2	R 11.7

7.2.8 Recommendations

To achieve the targeted rollout of SWHs it is recommended that provincial by-laws be legislated that make the installation of SWHs compulsory when an existing electrical geyser breaks down as well as on all new build houses in the middle to high income market. Furthermore, all new government subsidised housing projects should include the installation of SWHs whilst existing housing projects should be gradually retrofitted. 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 rollout project as a Carbon Offset project under the Clean Development Mechanism should be a priority.

Retrofitting can be undertaken as part of the Community Employment Programme, with young people with matric or higher education being trained to install – and maintain – SWHs. Recruitment, training, registering qualifications and so on would all be provided by the CEP, and once qualified in maintenance, graduates could be assisted in setting up their own SMMEs to provide on-going SWH maintenance and more general plumbing, electrical and related services.

To ensure maximum economic development is achieved the local SWH industry should be supported as much as possible. This could be through a subsidy scheme to local manufacturers or a preferential procurement system that supports locally made systems, or both (a subsidy scheme to kick-start, preferential procurement once the sector is up and running). It should be noted that ESKOM already offers a subsidy that could be used with the programme.

A critical factor in the successful rollout of SWH as a green economy initiative is the development of a financing scheme for the retrofitting of homes with SWHs. This could be included in the rates and taxes, or as a separate service from local municipalities. The potential of developing a cross-subsidisation scheme where a small additional amount is added to the interest rate for high-income households to finance SWHs in the low-income sector should also be investigated.

Alternatively, the possibility of providing hot water as a service can be investigated. Local municipalities could pay for the installation of SWHs on homes and retain ownership of the systems. A levy for the use of hot water from the system could then be added to municipal rates.

7.2.9 Proposed Rollout Strategy

The following roll-out strategy is proposed to maximise job creation potential and meet the targets discussed above:

Assumption Table	
Average collector size for high income households	2.3m ²
Average collector size for low income households	1.5 m ²
Nominal Power capacity of SWHs in South Africa per m ² collector area ⁷⁷	0.7 kW _{th} / m ²
Jobs created by locally manufactured SWH systems per MW capacity ⁷⁸	15/MW _{th}
Jobs created by imported SWH systems per MW capacity ⁷⁹	8/MW _{th}
Existing maximum manufacturing and installation capacity of South African SWH industry ⁸⁰	50 000m ² /annum
Potential growth rate of SWH industry ⁸¹	26%

⁷⁷ Figure provided by The European Solar Thermal Industry Federation (ESTIF) and the IEA SHC Programme in Holm, *Market Survey of Solar Water Heating in South Africa*

⁷⁸ Based on data provided by Agama Energy, *Employment Potential of Renewable Energy In South Africa*

⁷⁹ *ibid*

⁸⁰ Based on data provided in the *Draft South African National Solar Water Heating Framework and Implementation Plan* and on the research findings of Holm, *Market Survey of Solar Water Heating in South Africa*, that there exists significant excess capacity amongst South African SWH manufacturers

⁸¹ Holm, *Market Survey of Solar Water Heating in South Africa*

Green Economy for Gauteng

Proposed rollout of SWHs and job creation potential with maximum local content																	
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
No of locally manufactured systems installed in high-income sector	0	4348	5478	6903	8697	10959	13808	17398	21921	27621	34802	43851	55252	69618	87718	110525	518898
No of locally manufactured systems installed in low-income sector	0	6667	8400	10584	13336	16803	21172	26677	33613	42352	53363	67238	83333	83333	83333	83333	633538
Total locally manufactured systems installed	0	11014	13878	17487	22033	27762	34980	44075	55534	69973	88166	111089	138585	152951	171051	193858	1152435
No of systems imported for high income sector	0	6522	9783	14674	22011	33016	49524	68043	68043	68043	68043	68043	68043	68043	68043	67617	747495
No of systems imported for low income sector	0	6667	6667	6667	6667	6319	0	0	0	0	0	0	0	0	0	0	32985
Total no of imported systems installed	0	13188	16449	21341	28678	39335	49524	68043	68043	68043	68043	68043	68043	68043	68043	67617	780480
Total jobs created by locally manufactured systems (20.8/MW)	0	291	367	462	583	734	925	1165	1468	1850	2331	2937	3670	4151	4758	5521	
Total jobs created by imported systems (10.9/MWh)	0	191	248	334	463	652	869	1194	1194	1194	1194	1194	1194	1194	1194	1187	
Jobs created in local manufacturing sector	0	139	175	220	277	349	440	555	699	880	1109	1398	1747	1976	2264	2628	
Total Jobs created in other sectors	0	343	440	576	768	1036	1354	1805	1963	2164	2416	2733	3117	3370	3687	4080	
Total jobs created	0	482	615	796	1045	1386	1794	2359	2662	3044	3525	4131	4864	5345	5952	6708	

7.2.10 Policy Recommendations

All the market requires to grow is regulatory certainty. We would recommend the following policy interventions to enable the market in Gauteng:

- New build
 - Mandatory installation at time of building.
- For High-income houses
 - Mandatory installation. This can be on sale of the house or within a certain timeframe. Alternatively, a levy can be charged on houses that do not have SWH and used to subsidise low-income SWH.
- Low-income houses
 - 50% subsidy, 50% recovered on loan basis
 - Subsidy value (low-income):
 - R 39 million per year for 15 years
 - Possible Carbon revenue of up to R 12 million per year

The DED should also liaise with the insurance industry about co-operating in this space.

7.2.11 References

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7.3 Energy Efficiency

7.3.1 Summary of findings

A 20% Energy Efficiency target could create over 10400 jobs, add R 640 million to labour income, reduce yearly expenditure on energy by over R16 billion / year with additional investment in equipment at around R10 billion / year. Provincial spend for a programme to enable would be around R13 million/year.

7.3.2 Introduction

Between 1973 and 2005 energy efficiency has already saved up to 58% of what was actually consumed, as illustrated in the following graph. There are still tremendous improvements that can be achieved in this space. “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”⁸²

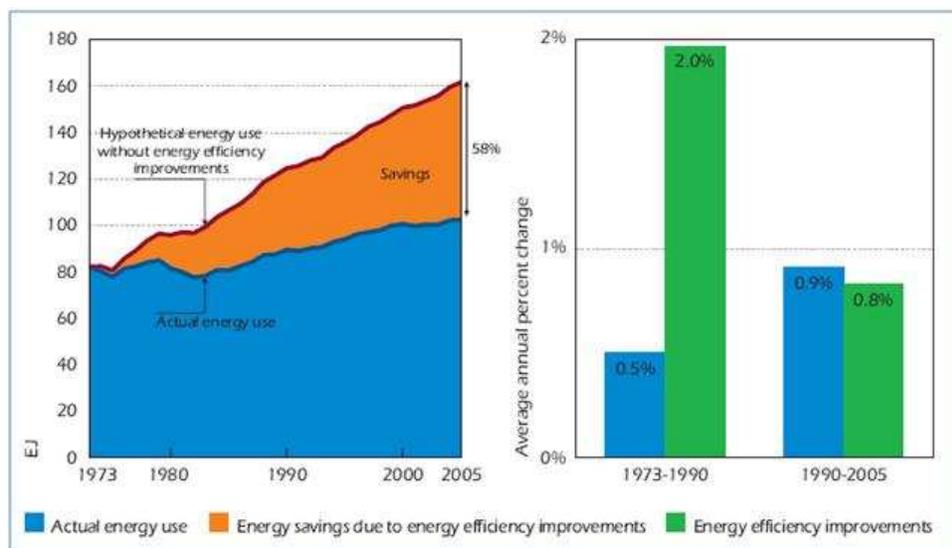


Figure 7: Long Term Energy Savings from Improvements in Energy Efficiency⁸³

“The benefits of more efficient use of energy are well known and include reduced investments in energy infrastructure, lower fossil fuel dependency, increased competitiveness and improved consumer welfare. Efficiency gains can also deliver environmental benefits by reducing greenhouse gas emissions and local air pollution.”⁸⁴

⁸² Laitner, “Understanding the size of the energy efficiency resource,” 351.

⁸³ IEA, *Worldwide Trends in Energy Use and Efficiency*, 26.

⁸⁴ *Ibid.*, 3.

Case study: USD654,350 investment in energy efficiency programs by the City of San Jose stimulated USD8.5 million in private sector investment. The City estimated that over an 11-year period, this would increase net employment by 1753 jobs, generate USD33 million incremental wages and salaries, and increase local spending by USD20.8 million.⁸⁵

The traditional way of creating energy capacity is to create more supply. However, this can also be achieved by reducing demand. If the two options are compared, then energy efficiency compared to conventional energy⁸⁶:

- Costs less per MWh
- Creates more jobs at less cost
- Stimulates more economic activity (Oil = 1.5x, Electricity 1.75x Energy Efficiency = 2.25x)
- Energy intensity is the measure of energy consumption per unit of GDP and is an indicator of energy efficiency.

7.3.3 Energy Intensity

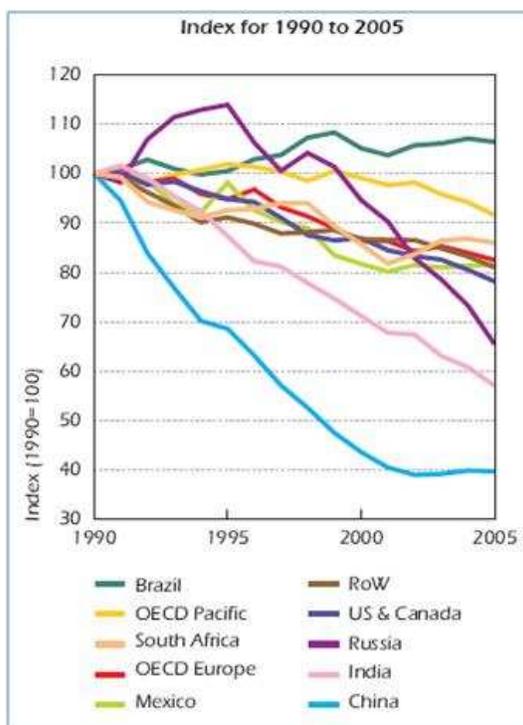


Figure 8: Energy Intensity as a function of GDP

The graph alongside shows that while many countries are reducing their energy intensity – China and India massively so –the energy intensity of South Africa actually increased between 2000 and 2005. In the graph, low scores are good, high scores (which equate with high intensity) are not good.

Thus there is tremendous potential in South Africa to create jobs and stimulate the economy through Energy Efficiency. A South African study showed “a 5% increase in electricity efficiency in 2010 would lead to a net increase of some 39 000 jobs and labour income of about R 624 million.”⁸⁷

“The benefits of industrial energy efficiency in South Africa include significant reductions in local air pollutants; improved environmental health; creation of additional jobs; reduced electricity demand; and

⁸⁵ Lee and Denlay, *Demand Side Management: Energy Efficiency Potential in South Australia*.

⁸⁶ *Ibid.*, 16-17.

⁸⁷ Winkler, “Energy policies for sustainable development in South Africa’s residential and electricity sectors,” 76.

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 SA’s total projected energy CO2 emissions by 2020.”⁸⁸

The following tables and graphs, produced by UCT’s Energy Research Centre, show something of what can be achieved with Energy Efficiency.

Sector	Estimate of electrical energy saving	Ranking
Iron and steel	32%	1
Wood and wood products	20%	2
Chemicals	18%	3
Food and beverages	8%	4
Non-metallic minerals	8%	5

Figure 9: Percentage of electricity saving by industrial subsector⁸⁹

The table above shows the ranking of five sectors and how much energy could be saved through changing certain infrastructures. Some of the things that can be done to achieve these savings, and how much can be saved through efficient equipment, is shown in the table below.

Measure	Percentage of total electricity savings	Ranking
Compressed air management	26%	1
Variable speed drives	18%	2
Efficient motors	17%	3
Efficient lighting	12%	4
Load shifting	9%	5
Heating, ventilation and cooling	6%	6
Other thermal measures	6%	7
Refrigeration	4%	8
Steam systems	1%	9

Figure 10: Electricity saving by measure⁹⁰

The following graph shows that energy efficiency is an excellent way to produce carbon emission savings while producing jobs.

⁸⁸ Winkler H, Howells M, and Baumert K, “Sustainable development policies and measures,” 212.

⁸⁹ Ibid., 218.

⁹⁰ Ibid.

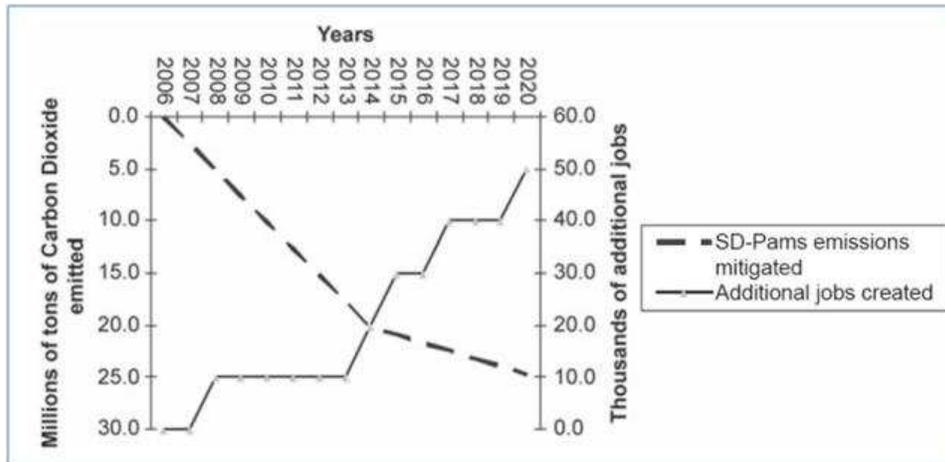


Figure 11: Job creation potential and CO₂ savings⁹¹

7.3.4 Gauteng Targets

The proposed Gauteng target is a 15% improvement in energy efficiency by 2025. When considered against what other countries are seeking to achieve (e.g. 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%. However, for the purposes of this calculation we will use both the target value of 15% as well as the option of a target of 20%.

⁹¹ Ibid., 219.

7.3.5 Calculations

The table below shows what can be achieved in terms of growth through energy efficiency.

	15% Target 2025	20% Target 2025
Business-As-Usual Gauteng Energy Consumption 2025⁹²	999.5 PJ	999.5 PJ
Energy saved through efficiency	149.9 PJ saved in 2025	199.9 PJ saved in 2025
Energy cost saved⁹³	R 12 billion / year	R 16 billion / year
Jobs creation potential	50 jobs/PJ ⁹⁴	50 jobs/PJ ⁹⁵
Jobs created by 2025	7,500 minimum	10,400 minimum
Monthly salary per technician	R 5000	R 5000
Total yearly salary revenue in economy	R 450 million	R 624 million
Total asset expenditure on energy efficiency equipment in economy	Approx R7.5 billion per year	Approx R10 billion/year
Economic return on energy efficient initiatives	Typically 2x on investment over 4-6 years.	Typically 2x on investment over 4-6 years.
Estimated cost to Province to establish programme⁹⁶	R 10 million / year	R 13 million / year

7.3.6 Economic Interventions

Possible interventions in the Energy Efficiency space include:

- Enable municipalities to be rewarded for driving energy reduction rather than for sales of electricity. This model has been successfully applied in California.
- Educating energy users to the savings that can be achieved through energy efficiency.
- Implementing compulsory Energy Efficiency Standards.
- Providing access to finance for energy efficient equipment.

7.3.7 Specific Energy Efficiency Interventions

⁹² Dept of Local Gov & Housing, *Gauteng Integrated Energy Strategy*, 48.

⁹³ Assuming the low value of R0,30 per kWh

⁹⁴ Lee and Denlay, *Demand Side Management: Energy Efficiency Potential in South Australia*.

⁹⁵ Ibid.

⁹⁶ Assuming a large programme to drive policy, create awareness of energy efficiency and promote skills training in energy efficiency. Figures estimate.

The following specific energy efficiency interventions in various sectors could be promoted:

- Industrial sector⁹⁷:
 - Variable speed drives: These drives reduce unnecessary power consumption in electrical motors with varying loads
 - Efficient motors: These motors are available at higher cost. Efficient motors can reduce power consumption, but may require modifications because running speeds are generally higher than for inefficient motors.
 - Compressed air management: This measure is easily achieved and often results in significant savings at low cost.
 - Efficient lighting: These measures take advantage of natural lighting, more efficient light bulbs and appropriate task lighting
 - Heating, ventilation and cooling: These measures are for maintaining good air quality and temperature and can commonly be improved through better maintenance and the installation of appropriate equipment.
 - Thermal saving: Thermal saving refers to more efficient use and production of heat. For steam systems in particular we consider condensate recovery and improved maintenance.
- Commercial sector
 - Energy efficient windows
 - Insulation
 - Better managed air infiltration and cool -> hot air heat exchange.
 - Advanced air-conditioning and HVAC systems
 - Efficient Lighting
 - Green IT
- Residential sector
 - Supply & install energy efficient lights (e.g. CFLs) to replace incandescent bulbs;
 - Installing ceilings and other no-cost measures to improve the thermal efficiency of the buildings (e.g. proper orientation on the site);
 - Promote more efficient appliances (e.g. refrigerators);
 - Switch from electricity and/or paraffin to LPG for cooking;
 - Energy efficient water heating (low-pressure solar water heaters).
- Transport Sector
 - Switch from cars to mass transport systems (rail, bus rapid)

Each of these initiatives usually has commercially viable paybacks. What is needed is business education about this as well as the right financing infrastructure for the asset equipment.

⁹⁷ Howells and Lainter, *Industrial Efficiency as an Economic Development Strategy for South Africa*, 51.

7.4 Concentrated Solar Power Industry

7.4.1 Summary of Findings

The following figures are based on meeting the proposed 16% Renewable target for Gauteng from predominantly Concentrated Solar Power (CSP).

Total amount of CSP (with 6 hours storage) to be installed if a 16% electricity from Renewables by 2025 are to be achieved	1413 GW
Estimated total cost of CSP plants to be build by IPPs	R 90.5 billion
Total conventional electricity saved per year	5.2 TWh/a
Carbon emissions averted per year (metric ton)	4 378 248 tons
Current CSP REFIT (Parabolic Trough with 6 h storage)	R 2.10/kWh
Total new permanent jobs on CSP power plants	1000
Number of jobs for permanent construction team (assuming 100 MW of CSP is constructed per year)	900
Indirect jobs in the Gauteng province due to CSP plants being build	4000 new jobs per year

Figure 12: Summary of CSP Industry

In addition, the price of electricity with 16% CSP is likely to be less expensive than that of 100% fossil fuel based electricity in the residential sector by 2025: R3.88/kWh for 100% coal vs R3.59/kWh for 84% coal and 16% CSP⁹⁸.

7.4.2 Introduction and potential of CSP within the Gauteng Province

Concentrated Solar Power (CSP) refers to the method of generating electricity by concentrating the power of the sun. A typical CSP plant is 50 MW or above in size. Storage of up to 7.5 full load hours has been proved commercially in Europe in the past few years. Most CSP technologies incorporate a certain percentage (up to 15 % is allowed under the SA REFIT) of backup fuel for overcast periods. Combining storage with backup fuel results in CSP becoming a dispatchable source of green electricity.

In two recent reports (Energy Research Centre, 2007; Banks and Schäffler, 2005) the implementation of large concentrating solar power (CSP) plants has been proposed as one of the main contributors to greenhouse gas emission reductions in South Africa.

Fluri (2009) identified provinces in South Africa with good potential for the implementation of large-scale concentrating solar power plants using geographic information systems. The following criteria were taken into account: solar resource, proximity to transmission lines, land use profile and slope. The potential sites identified are located in the Northern Cape, the Free State, the Western Cape and, to a minor degree, the

⁹⁸ It should be noted that an accelerated CSP programme with a larger portion of Renewables could be even cheaper than this.

Eastern Cape. The implementation of actual CSP plants in Gauteng would not be as viable as for the provinces mentioned. This is mainly due to the relative low solar irradiation compared to the other regions in South Africa. However, energy generated with CSP from surrounding areas could be imported through the national grid into Gauteng.

Gauteng could also leverage its manufacturing facilities and skills to develop a R&D centre and manufacturing industry around CSP over the next 15 years.

7.4.3 The potential of importing CSP energy

As shown in Figure 13, the potential CSP sites nearest to the Gauteng province are in the southern Free State and the north-eastern Northern Cape. The distance from these sites to the centre of the Gauteng province is approximately 500 km. These two provinces have sufficient solar resource and flat land to meet the current energy demand of the entire Gauteng province.

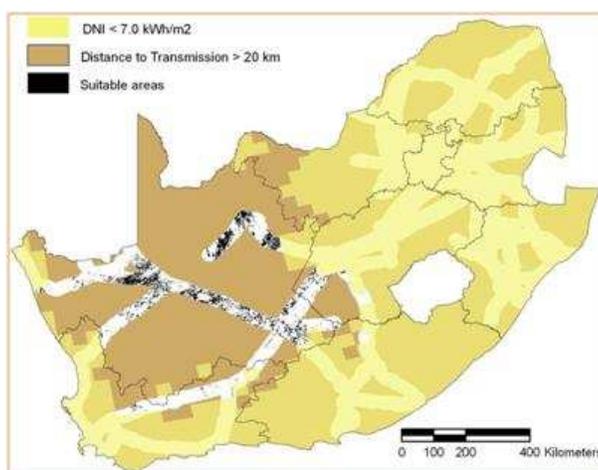


Figure 13: Map of South Africa indicating areas which are suitable for the installation of large concentrating solar power plants (Fluri, 2008)

7.4.4 Current and projected (2025) provincial electricity demand in Gauteng

The Gauteng provincial electricity consumption for 2007 was 19.32 TWh. When considering the business as usual scenario the demand increases to 25.3 and 32.2 TWh/a by the years 2014 and 2025, respectively (based on figures provided). This is a 25 and 52 % increase from 2007, respectively.

For the 2025 target of 16 % power from Renewables to be met, 5.2 TWh/a would need to be used from renewable resources. From the above information the required installed CSP capacity is approximately 1413 MW⁹⁹. At an estimated cost of R 64 million/MW this equates to a total cost of R 90.5 billion.

⁹⁹ Based on a capacity factor of 42% for a parabolic trough plant with 6 hours storage for the proposed sites (Fluri et. al. 2010).

7.4.5 Plan to achieve 16% power from Renewables

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 (IPP) whom 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 (PPA) being issued.

One way to overcome this hurdle is by a private wheeling agreement. The Gauteng province could facilitate the PPA process by acting as the buyer's office whereby they purchase the green electricity from the CSP plants (build by IPPs) and reselling them to private customers seeking to buy green electricity. A similar scheme has been established in the Western Cape between the 5.4 MW Darling wind farm and the City of Cape Town Municipality.

Case study: The City of Cape Town has set a target of 10 % of the metro's energy should come from renewable sources by 2020. In the pursuit thereof they will purchase all the green electricity to be generated by Phase 1 (5.4 MW) of the Darling Wind Farm for 20 years. The wind turbines have been commissioned and the city of Cape Town has begun purchasing renewable electricity from the wind farm.

Currently the REFIT for CSP with 6 hours storage is R 2.10/kWh. An average household pays around R 0.70/kWh and large industry pays around R 0.21/kWh (Eskom, 2009). Initially R 2.10 /kWh may appear very high, but over time the benefits can be seen, as shown in the table below. If households include 16 % of CSP into their electricity usage their electricity price will increase from R 1.72/kWh to R 1.78/kWh in 2012, and decrease against the baseline case from R3.88/kWh to R3.59/kWh by 2025.

The effect of adding 16 % of CSP electricity into the mix is less attractive for industry, who currently pay an exceptional low rate for electricity. It should be noted that, in a similar way as wheeling CSP is encouraged here, other Renewables of a lower cost could also be considered. In SA the wind industry is more mature and ready for large installations than CSP with a REFIT of R 1.25/kWh.

Year	Predicted Eskom Tariff Increase	Cost of Residential Electricity without CSP*	Cost of Residential Electricity with 16% CSP**	Average Increase in Electricity Price	Cost of Industrial Electricity without CSP#	Cost of Industrial Electricity with 16 % CSP**	Average Increase in Electricity Price
2010	35%	R 0.70	R 0.92 ***	32%	R 0.21	R 0.51	59%
2011	35%	R 0.95	R 1.13 ***	20%	R 0.28	R 0.57	51%
2012	35%	R 1.28	R 1.41 ***	10%	R 0.38	R 0.66	42%
2013	7%	R 1.72	R 1.78 ***	4%	R 0.52	R 0.77	33%
2014	7%	R 1.84	R 1.88 ***	2%	R 0.55	R 0.80	31%
2015	7%	R 1.97	R 1.99 ***	1%	R 0.59	R 0.83	29%
2016	7%	R 2.11	R 2.11	0%	R 0.63	R 0.87	27%

2017	7%	R 2.26	R 2.23	-1%	R 0.68	R 0.90	25%
2018	7%	R 2.42	R 2.37	-2%	R 0.72	R 0.94	23%
2019	7%	R 2.58	R 2.51	-3%	R 0.78	R 0.99	21%
2020	7%	R 2.77	R 2.66	-4%	R 0.83	R 1.03	20%
2021	7%	R 2.96	R 2.82	-5%	R 0.89	R 1.08	18%
2022	7%	R 3.17	R 3.00	-5%	R 0.95	R 1.13	16%
2023	7%	R 3.39	R 3.18	-6%	R 1.02	R 1.19	15%
2024	7%	R 3.63	R 3.38	-7%	R 1.09	R 1.25	13%
2025	7%	R 3.88	R 3.59	-7%	R 1.16	R 1.31	11%

Figure 14: Effect of adding 16 % of CSP power into residential and industrial electricity usage

* Based on the assumption that Municipalities will increase the residential electricity rate with a similar increase as the Eskom tariff increases, as has been the case in the past few years

Based on the 2009/2010 Eskom’s Night Save Urban (Large) Tariff

** Based on the REFIT of R 2.10/kWh for all years (no decrease due to increase of global installed capacity no increase due to inflation)

*** Note that for the first six years CSP power is MORE expensive. This is because of the cost to amortise the investment in asset infrastructure required.

7.4.6 Cost of CSP vs Coal fired power stations

The cost of Eskom’s 4800 MW Medupi power station has an estimated cost of R 124 billion (Engineering New, 2009a). This equates to an installed cost of R 25.8 million/MW. The cost for the second new Eskom power station, Kusile, is likely to be higher. The LEC of new coal is estimated at R 0.48/kWh (Meyer, 2010).

The installed cost for a new 50 MW CSP plant with 6 hours storage is estimated at R 3.2 billion Rand (based on figures for CSP plants recently constructed in Spain). This equates to R 64 million/MW installed. This figure is likely to decrease with larger CSP plants and as the total installed capacity of CSP increase over the next decade. Currently the REFIT for this technology is R 2.10/kWh. It is likely that the REFIT will be adjusted downwards in the future if the LEC cost of CSP power plants drop.

However, with the escalating prices for fossil fuels and the diminishing LEC for Renewables, specifically CSP, grid parity (point at which renewable electricity is equal to or cheaper than grid power) will be reached in the near future. 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).

7.4.7 Job creation / protection potential

The main conclusion of Fluri’s study (2009) is that there is indeed a huge potential for CSP in the South Africa. It was also shown that the Gauteng province does not possess significant viable sites for CSP plants (according to the criteria stipulated in the study). However, Gauteng has the manufacturing capabilities to have a major share in the local manufacturing of CSP plant components. This could lead to a new industrial sector which will require human capital ranging from basic labour to highly skilled personnel.

In addition to manufacturing, Gauteng could 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.

Initially existing manufacturing capabilities in the province could be utilised to manufacture CSP components locally e.g. steel structures for the troughs, steam and oil pipes, pumps, molten salt, heat exchangers, etc. This would only be for components that can currently be manufactured.

As the number of installed CSP plants in SA grew, it would justify the establishing of certain key component manufacturing in SA. E.g. curves mirror and collector tubes. The province should make it attractive for such manufacturing facilities to be located within the province. One method of achieving this is through a dedicated “green” industrial development zone. Such a zone would have incentives like low rent for an initial period, easy access to transport (e.g. rail), electricity, water and other services. Tax reductions and lower levies would also be incentives.

Initially such an IDZ would focus on manufacturing but should be grown into a R&D centre. The R&D centre would then attract additional manufacturing.

At this stage it is difficult to predict the number of jobs such an IDZ would create. As an indication we look at the CSP industry in the US. A 100 MW CSP planned for Nevada in the US is predicted to create as many as 450 construction jobs for Nevada during the two-year construction period. It will employ 45 permanent operations staff. It will have an annual operating budget of more than \$5.0 million. In addition, up to 4,000 indirect jobs would be created through the use of locally based suppliers and service providers (Renewable Energy World, 2009).

If we draw in these figures, and we estimate that 100 MW of CSP constructed per year will have their base in the Gauteng’s Green IDZ, then we can assume the following:

- A team of construction workers of 900 staff will be required in a construction team
- Each year 45 new staff will be appointed on CSP plants
- \$ 5 million (About R 40 million) will be budgeted per plant for O&M. This will go to salaries, consumables (water, backup fuel) and maintenance (spare parts).
- Each new 100 MW plant would attract an investment of R 6.4 billion

7.4.8 Benefits of CSP compared to current energy generation technologies

7.4.8.1 Pollution & carbon-emissions

Currently, South Africa is predominantly dependent on coal as fuel for electricity generation. Approximately 92 % of electricity is generated with coal fired power stations.

The major shortcoming of coal fired power stations is, in short, the fuel. This is a two part problem. Firstly, it has been reported that fossil fuel reserves are dwindling. Secondly, the burning of coal has an adverse impact on the environment as carbon dioxide and other pollutants such as soot, benzene, carbon monoxide, sulphur oxides and ammonia are released into the environment. With CSP plants the input energy for the boiler is in predominantly the form of solar energy. Fossil fuel backup up to 15 % is allowed under the SA REFIT. It should be pointed out that backup fuel (natural gas) as little as 2 % has been demonstrated in the 64 MW Nevada Solar One parabolic trough plant in the US. If the targets set for 2025 are obtained, then 4 378 248 tonnes of CO₂ per year would be omitted. This is based on an Eskom average CO₂ emission of 1 kg of CO₂ per kWh generated and a 15 % backup fuel usage by the CSP plant producing 1 kg per kWh generated.

7.4.8.2 Water consumption

The water consumption for both CSP and coal fired powered station plants is significantly influenced by the type of cooling utilized; either wet or dry cooling. Dry cooling uses approximately 5% - 10% of the water consumed with wet cooling.

Most of the power stations in South Africa employ wet cooling. As shown in Table 3 the addition of CSP into the electricity generation mix does not necessarily reduce water consumption. With many of the potential CSP sites wet cooling is not an option. Eskom’s two new power stations, Medupi and Kusile, both utilises dry cooling.

Coal		CSP – Parabolic trough		CSP – Central Receiver (Rankine Cycle)
Dry	Wet	Dry	Wet	
0.1 [#]	1.9 [#]	0.4 - 0.55 ^{**}	4 – 5.5 [*]	0.08 – 0.11 ^{##}

Table 3: Water Consumption (Dry and Wet refer to cooling types) [litres/kWh]

Eskom, 2010

* Solar Millennium, 2010

** Based on 10 % the water consumption of a wet cooled parabolic trough plant

Based on 2% of the water consumption of a wet cooled parabolic trough plant, water only required for mirror cleaning

7.4.9 Job Creation

The table below compares different CSP power plants with a coal fired power station in SA.

Name, size and location	Permanent jobs	People/MW	Reference
Matimba, 4000 MW coal power station, South Africa	750	0.18	Eskom, 2010
Andasol I, 50 MW with 7.5 h storage, Spain	50	1.0	Flagsol, 2009
Nevada Solar One, 64 MW no storage, US	28	0.44	Cohen, 2008
Crescent Dunes, 100 MW with storage, US	45	0.45	Renewable Energy World, 2009

Study, 100 MW plant	94	0.94	Stoddard, 2004
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Table 7-4 Permanent jobs in power stations

From these figures it can be seen that CSP plants employ more people per MW than coal fired power station. It could be argued that a smaller power plant will employ more people per MW, but CSP plants are smaller in size compared to coal power plants. The largest CSP plant in operation is currently a 80 MW parabolic through plant in the US.

Based on the figures above it is estimated the 1413 MW CSP required will employ about 1000 permanent people.

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7.5 Water & Sanitation

7.5.1 Introduction

This review of water related issues aims to identify strategic areas in which Gauteng DED, as part of its green agenda, can engage to mobilise activities that:

- Enhance sustainability
- Promote economic development, including, specifically
- Create jobs; and
- Support effective service provision.

For the purposes of the review, a distinction is made between the water services (water supply and sanitation) and water resources (water found in rivers, reservoirs and underground).

The situation in each of these domains is reviewed, institutional responsibility and current programmes of activity and intervention delineated and specific challenges and opportunities identified.

7.5.2 Context

Gauteng is responsible for a high proportion of South Africa's economic product and home to more than 20% of the country's population but generates only a small proportion of the country's water resources. Total estimated "runoff" from the province is less than current piped water use.

An important initial consideration is that of existing mandates.

Water services (water supply and sanitation – water in pipes) are mainly the responsibility of municipalities. The province is fortunate in having two regional water service organisations (Rand Water and the East Rand Water Care Company ERWAT) which provide high quality bulk services. The implications of the recent transfer of responsibilities for sanitation to the National Department of Human Settlements are not yet clear. However, the expressed intention of this Department to ensure that a sustainable water approach built into every new housing projects that receives housing subsidies may create useful opportunities for innovation.

Water resource management (water in rivers, dams and underground), including the allocation of water, licensing of discharge and regulation of quality is the responsibility of the national Department of Water Affairs.

Provincial government currently has a limited direct role, related to the housing function (see above) and some environmental functions which impact on pollution. However, development strategy for which the province is responsible has a significant impact on the water environment and water management.

There is worldwide interest in the identification of appropriate strategies for countries and communities to meet their water challenges. A report recently prepared by the McKinsey consultancy for the IFC and a group of multinational companies detailed some of these. In general, it found that there were many

different strategies for addressing water demands and pressures on the resource and, while the economic costs could be ranked, the implementation challenges and political contexts would have significant effect on strategies chosen.

“... meeting all competing demands for water is in fact *possible at reasonable cost*. This outcome will not emerge naturally from existing market dynamics, but will require a concerted effort by all stakeholders, the willingness to adopt a total resource view where water is seen as a key, cross-sectoral input for development and growth, a mix of technical approaches, and the courage to undertake and fund water sector reforms.

On South Africa, one of its case studies, it concluded that:

Demand in South Africa is projected at 17.7 billion m³ in 2030 with household demand accounting for 34 percent of the total. Against this, current supply in South Africa amounts to 15 billion m³, and it is severely constrained by low rainfall, limited underground aquifers, and reliance on significant water transfers from neighbouring countries. South Africa will have to resolve tough trade-offs between agriculture, key industrial activities such as mining and power generation, and large and growing urban centres.

Of interest was the fact that the analytical approaches used by McKinsey closely followed practices which have been used in South Africa for the past twenty years.

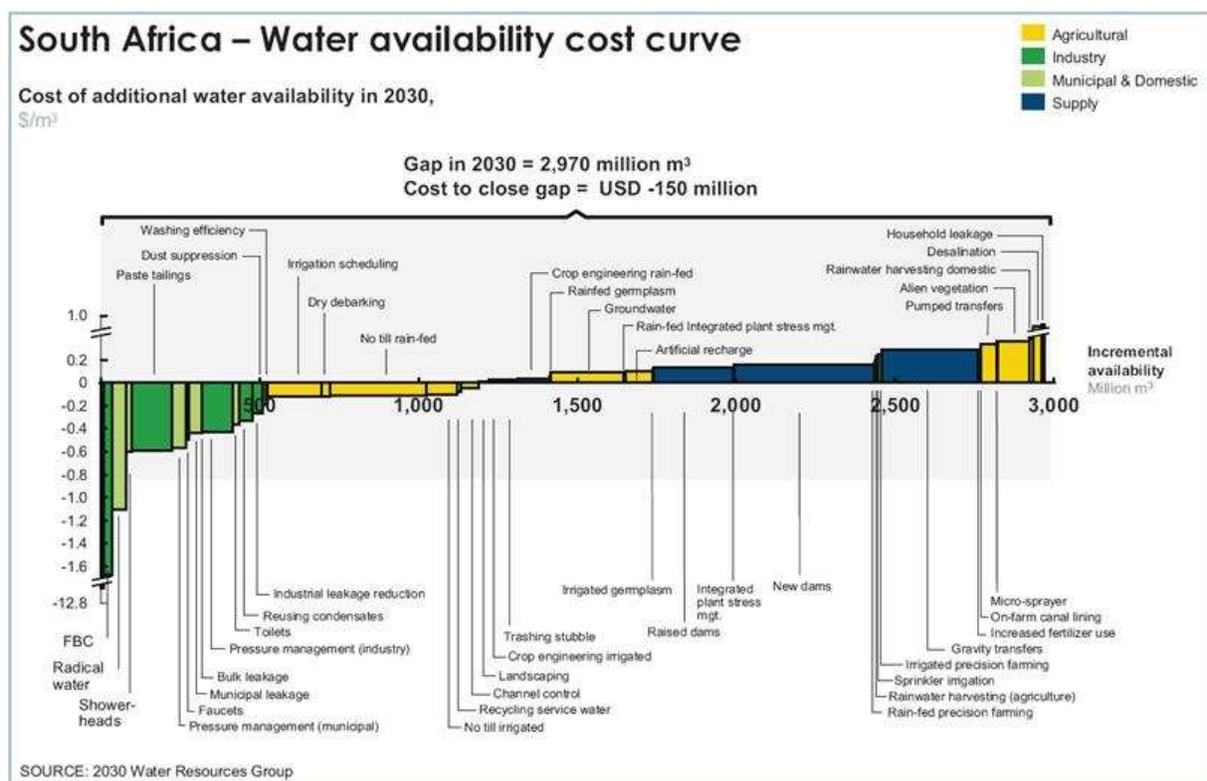


Figure 15: McKinsey water availability cost curve

7.5.3 Water resources situation

WATER AVAILABILITY

Situated on the watershed between the Orange/Vaal and the Crocodile/Limpopo river systems, relatively close to the river sources, 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 in the figure below.

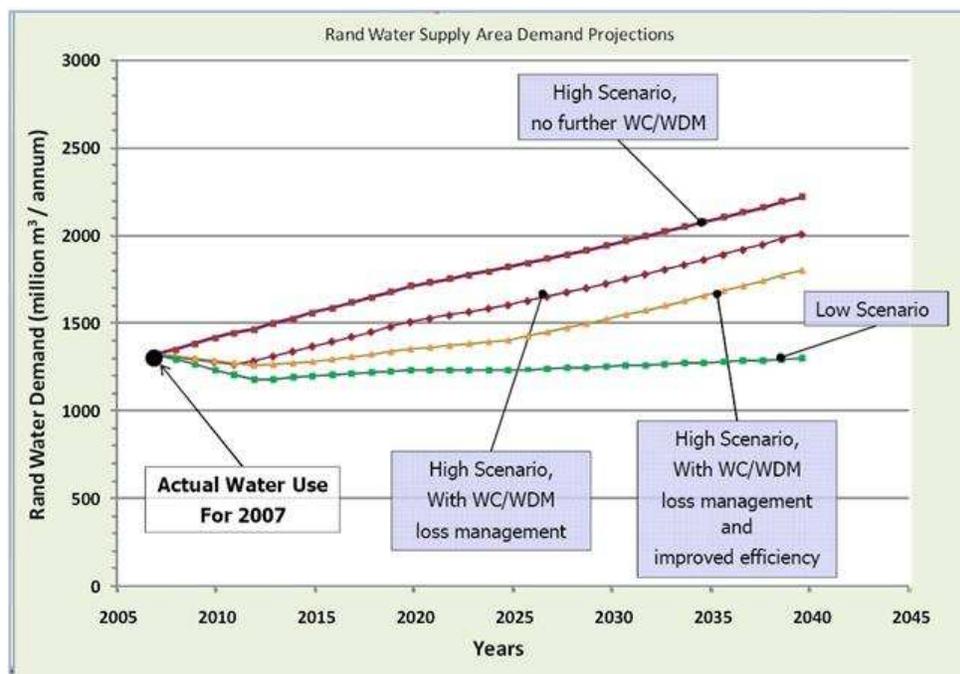


Figure 16: Rand water Requirement Scenarios

The date at which new supplies need to be brought on stream is highly dependent on consumption levels and, in turn, significantly impacts on water costs. An example of this scheduling is given below.

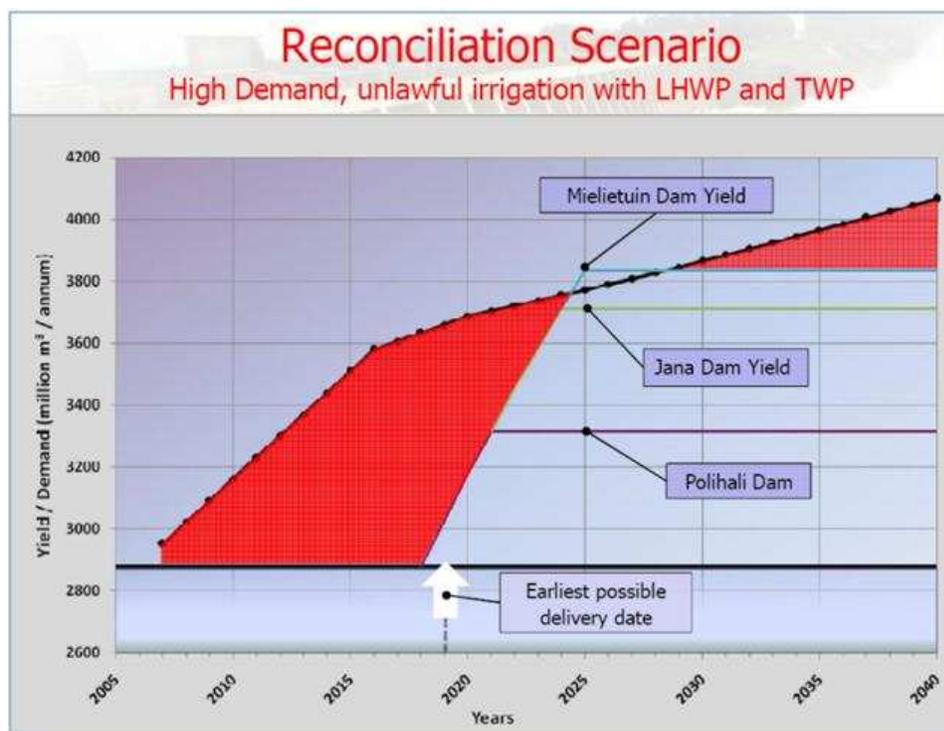


Figure 17: New water supply scheduling

Much of the water imported into the province is treated and discharged to neighbouring provinces where it is reused. The major part of the flow in the Crocodile river, a tributary to the Limpopo derives from water used in Gauteng. Additional quantities of wastewater are earmarked for the expansion of the coal-based industries of north west Limpopo Province. Current perspectives on the two sub-catchments in which Gauteng falls (Crocodile River West and Upper Vaal) are contained in the DWA's National Water Resource Strategy (2004) which is scheduled to be revised in 2010.

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 that leading to overall high water salinity that, if it reaches excessive levels, renders water unusable without desalination

"Water quality in the Vaal River and in some tributaries downstream of Vaal Dam is seriously affected by urban and industrial and mining return flows and the intensive mining activity. The

water resources are therefore carefully managed to maintain acceptable water quality standards. Particular attention is also to be given to the impacts that closure of mines may have on both surface and groundwater.” (NWRs 2004)

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 waste water 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 plant and investment in expansion of treatment capacity.

As mentioned above, there are current proposals to export substantial quantities of wastewater to supply coal and energy industry development in the water-deficient Lephalale area of Limpopo Province; this will reduce pollution of the Vaal. This is already being done through the sewage system which disposes of used Vaal water in the Crocodile catchment. However, poor management of sewage works and other urban pollution contribute to the water quality problems in Hartebeespoort Dam.

The diagram below shows the salinity status of the Vaal River and the build up in salinity as the river flows through Gauteng.

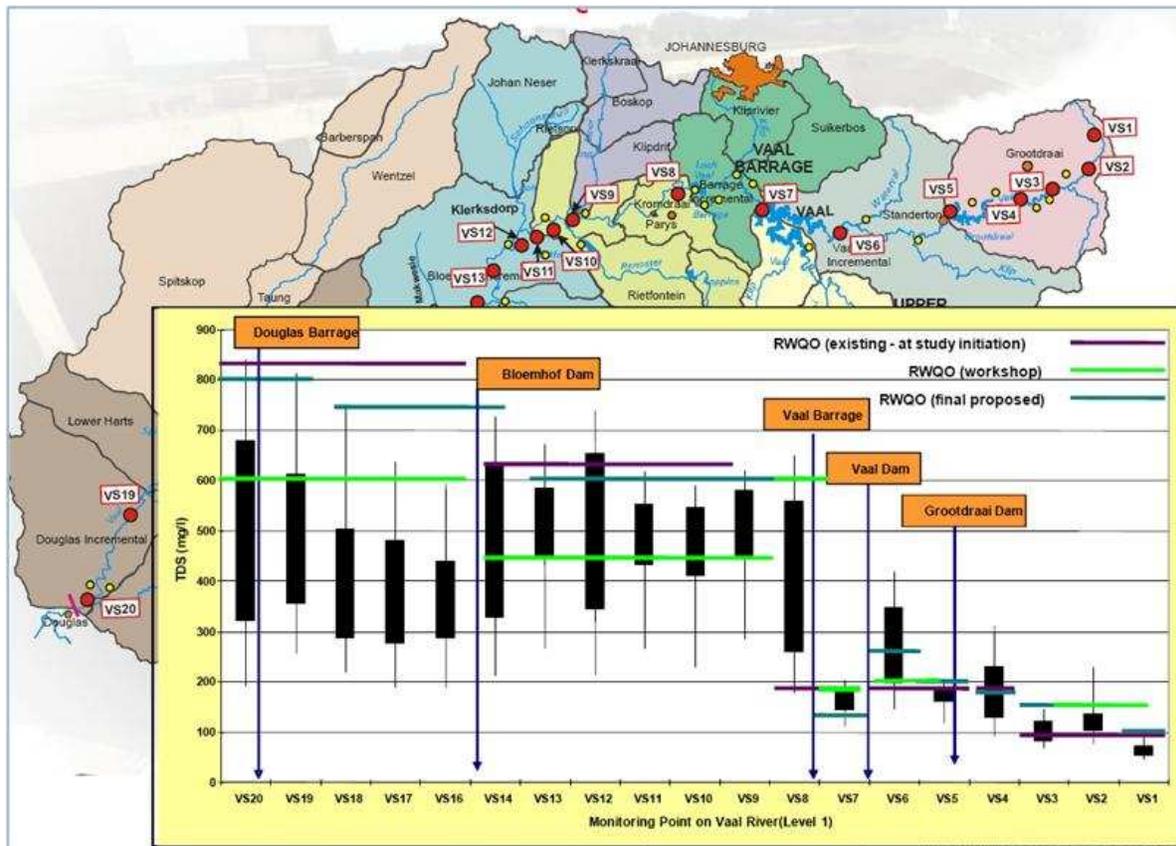


Figure 18: Overview of water quality - salinity status

7.5.4 Overview of water quality status

IMPLICATIONS FOR ECONOMIC DEVELOPMENT

At a strategic level, it is critical that water constraints are recognised by all sectors and guide the economic and social development of the Province. “Wet” and polluting industries should be discouraged and emphasis placed on low water intensity/high productivity knowledge and service industries. The recreational, tourism and property value of clean water resources should be recognised as well as the impact of economic and social activities in the province on neighbouring communities.

Water services situation

WATER SUPPLY

The Province has high levels of coverage with water supply which meet basic standards. According to the department of water affairs, which regulates water services, in April 2009, only 30212 people (9622 households) were reported to have no water supply infrastructure, out of a population of 10 900 000 people (3410 000 households).

190 500 people (60 100 households) were reported to be with access below basic minimum standards which were set at the basic level of the RDP. These were mainly in Johannesburg (83 000 / 27320) and Ekurhuleni (69 000 / 21 810).

In terms of the affordability of access, free basic water is in place in all the municipalities of Gauteng, operating in parallel with indigency systems.

Traditional definitions of unaccounted for water include:

- water taken and used but not metered or paid for,
 - including leaks and waste on unmetered private properties
- leakage from the public distribution system

UAW levels vary greatly from municipality to municipality and between areas within municipalities.

Estimates range from 19% in Ekurhuleni (although it is not clear whether all losses are included) to 33.6% in Johannesburg (where the Phiri Constitutional Court challenge to the municipality’s approach to metering was blamed for a 2% deterioration in the UAW levels). Effective and sustained reduction of UAW depends on the implementation of management systems which can monitor and respond to consumption patterns. All municipalities are required to have water conservation/demand management programmes but these have generally not achieved the targets set.

WC/WDM measures

- **Loss management**
 - Pressure management
 - Retrofitting and removal of wasteful devices
 - Improved management (sectorisation, metering, billing, legislation)
 - Mains replacement
 - Leak detection and repair
 - Potential savings, 15% of use
- **Improved efficiency**
 - Efficient appliances: (washing machines, toilet cisterns etc)
 - Low flow shower heads
 - Water efficient gardens
 - Potential savings, further 15% of use

WAPSA logo:  water & forestry logo: 

SANITATION

Sanitation is more problematic. In the province 1 319 100 people (407 900 hh) were reported to lack access to at least basic levels of sanitation service. 401 660 / 131 630 in Johannesburg; 378 510 / 121 460 in Tshwane and 287 450 / 90 640 in Ekurhuleni with substantial backlogs (50 000/ 15000+) in Emfuleni, Kungwini and Mogale City. This backlog is largely related to the rapid expansion of unserved informal settlements; it represents significant threats to water quality. Even where sanitation provision is nominally adequate, this is often achieved using chemical toilets shared between families which does not meet the policy recommendation that each household should have their own toilet in order to achieve health objectives.

Currently, the province and most municipalities appear to be committed to providing water-borne sanitation in new settlements. This may open the way for piloting innovative approaches to the design of water and sanitation services which could involve rainwater harvesting, recycling of grey water for . The development of local treatment facilities, which has been suggested, may be more problematic given the requirement in the Gauteng area that wastewater treatment achieve high levels of nutrient removal. The application of simple technologies, such as reed-beds, perhaps linked to urban agriculture, would lead to the loss of a substantial proportion of the water which is needed by (and allocated to) downstream users and is required to maintain environmental flows.

IMPLICATIONS FOR ECONOMIC DEVELOPMENT

The effective provision of water services is an important contribution to economic development, creating an environment conducive to both social and economic activity. The cost of provision of water services

represents a substantial proportion of municipal budgets and is thus a determinant of municipal viability. Two linked threats to ongoing service provision are the extent to which services are subsidised and the pace of ongoing system investment and replacement. If funding for social provision undermines investment budgets, the ongoing ability of systems to provide reliable services will be compromised.

7.5.5 Strategic issues

Although they are all linked, a distinction continues to be made between water supply and waste water disposal; as well as the water resource and water-related areas where failure to act will prejudice (or where action could benefit) the people of the Province.

Water resource issues

Economic development focal points.

- Assured supply of adequate bulk water is critical for the development of the Province. This requires action on the demand side as well as on the supply side. While the supply side has been successfully managed to date by DWA in cooperation with Rand Water and TCTA, the water conservation/demand management activities, the responsibility of the municipalities, have generally failed to achieve their targets.
- Recreational use of water is an important economic opportunity that is being lost at present
 - International sporting competitions at a purpose-built site on Roodeplaat dam outside Pretoria were cancelled, due to pollution. This also impacts on the Province's efforts to develop the Dinokeng leisure and tourism opportunities;
 - recreational use and real estate potential of the Vaal in Emfuleni is recognised as a significant opportunity; it is severely constrained by the fact that water in the Vaal river between the barrage and Vaal Dam is often not safe for use.
 - Recreational use of Hartebeespoort dam is impacted upon by pollution from Gauteng.
- In general, water pollution increases costs for other users. This principally affects users downstream of Gauteng but their constrained development may impact on the province.
- Pollution from mining sources is a complex problem. Although related to the closure of old mines, much of the pollution is currently "mobilised" by ongoing mining activities – pumping of surplus water to enable mining to take place generates substantial flows through old workings. The profitability of marginal mining companies is closely linked to their pumping and treatment costs. While significant volumes of pollution originate inside Gauteng, its impact is primarily on neighbouring provinces. An exception is the growing pollution from coal mining in Mpumalanga which is impacting on quality in the Upper Vaal catchment.
- In the south east of the province, extensive wetlands (some artificially created by mining activity) perform an important function in mitigating pollution from urban and mining activities. They also represent a natural attraction and some are formally declared nature reserves and need to be protected from development.

DED would have a clear mandate to promote remedial action in these areas.



The slide features a background image of a dam with water cascading over spillways. The title 'Salinity Management Strategy' is prominently displayed at the top in red. Below it, the heading 'Short term actions:' is in blue, followed by a list of five bullet points. The fourth bullet point is highlighted in red. In the bottom left corner is the VAAL logo, and in the bottom right corner is the logo for the Department of Water & Forestry, Republic of South Africa, with the number 57 next to it.

Salinity Management Strategy

Short term actions:

- Continue with dilution releases to manage TDS concentration in Vaal Barrage to 600 mg/L
- Implement source controls
- Implement an upgraded monitoring programme
- **Feasibility study of target saline effluent treatment schemes**
- Pilot waste discharge charges

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Water supply issues

In the area of supply, the Province is essentially dependent on Rand Water which in turn gets its water from infrastructure operated by the DWA. The planning for these supplies is done jointly, with a horizon of 30+ years. Currently, discussion about the need to augment water supplies sometime around 2017 is focused on the potential for reducing demand. Demand management is firm policy, there are clear targets, but they are not being met. Since this is an agreed strategy of the various agencies of government focused primarily on Gauteng users, there is a legitimate interest for DED to engage. There are however significant social and political barriers to effective action as evidenced by civil society campaigns with slogans such as "smash the meter, enjoy the water" and Constitutional Court challenges to water management strategies.

Strategies to improve efficiency in water use in low-income areas frequently run into social and political obstacles as has been demonstrated in recent Constitutional Court cases involving water and sanitation in Ekurhuleni and Johannesburg. One lesson from these is that conservation and demand management measures should be applied across the community. The use of "grey water" for toilet flushing, a major water user in most households, is an example of an approach that can be applied in different ways across the Province.

Sanitation issues

There are significant challenges in establishing and maintaining effective sanitation provision in the province. In particular, service levels in low-income areas where sanitation and related infrastructure (including housing and local roads and storm water drainage) are not conducive to operation; this may be compounded by water shortages since low flows in sewers lead to blockages and spillages.

High-density low-income areas are also a significant challenge since poorly maintained buildings will often have significant discharges of sewage into storm water systems.

There are also substantial problems of social discipline in the use of sanitation systems with many examples of sewers being used for rubbish disposal causing blockages and overflows into the storm water system. Addressing this will require strengthened educational action.

7.5.6 Strategic opportunities

In the area of wastewater and pollution more generally, the main internal source of pollution problems is wastewater that escapes the sewage system. This is due to poor household maintenance (where waterborne sanitation exists), poor maintenance of the public infrastructure which is the responsibility of the municipalities but also of communities, and poor management of treatment works (in the smaller municipalities). Absence of infrastructure in informal settlements is also an issue. Industrial pollution from large enterprises is regulated but there are serious threats from smaller enterprises which need to be addressed.

Mining pollution is a complex and contentious issue involving responsibility for old and abandoned mines and the needs of the remaining marginal deep level mines . While there may be opportunities for collective

action to address the problem (as opposed to more rigorous regulation of existing polluters) this needs to be carefully and objectively assessed, bearing in mind the short remaining life of existing mines.

The challenge is to identify the many different impactors on water resources and prioritise interventions to address them in terms of cost, feasibility and overall impact.

Environment

The objective should be to get dams and rivers usable for recreation again, amongst them Roodeplaat, the Vaal Barrage as well as Hartebeespoort.

Water supply

A key strategic objective for the Province must be to collaborate with national and local institutions to achieve the objective of a 15% reduction in water use in the Province. This will delay the development of new infrastructure to augment supplies and thereby make more financial resources available for the operation, maintenance and expansion of municipal systems.

The Metros and Rand Water have water conservation and demand management programmes but these have not achieved the targeted savings and coordinated support from DED might contribute to improved performance. Resources are available through the DBSA which is managing a funded demand management programme for municipal implementation (details annexed). Water pricing is an important instrument in the promotion of efficient use and it is important that the price of water to large users (both domestic and industrial) should reflect the long run marginal costs of augmenting supplies so that appropriate investment and consumption decisions are taken. While domestic rising block tariffs and industrial tariffs have tended to these levels, this needs to be continuously reviewed and DED can play an important role in countering pressure for “moderate” price increases.

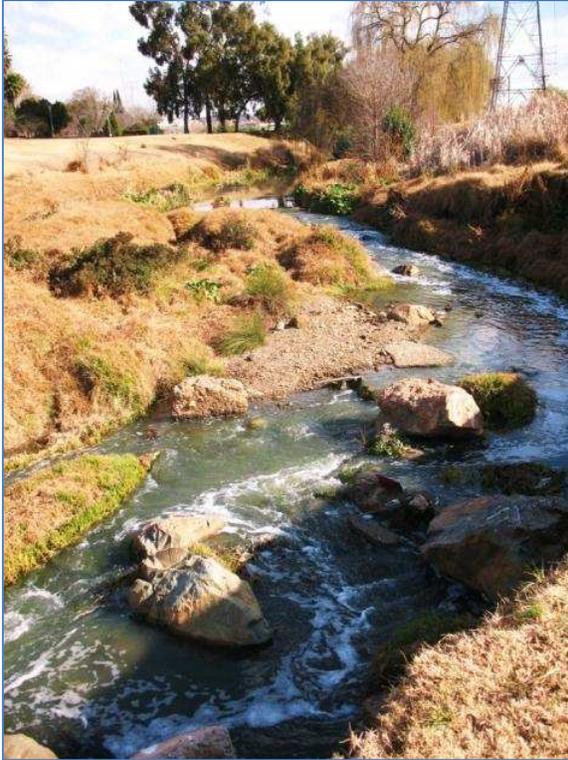
A longer term project with the potential to save significant energy as well as to reduce treatment costs and pollution risks is a proposal to build a pipeline to link the Ash river outfall to Rand Water’s works on the Vaal through which water would flow under gravity and arrive with residual pressure whose energy could be captured. This was studied and rejected as not cost-effective but changing energy costs and the availability of CO2 mitigation funding suggest that it may be appropriate to review it.

Sanitation

A key strategic objective is to reduce pollution by getting wastewater into the right pipes and keeping it there. Although the sanitation backlog is relatively small, poor sanitation results in “diffuse pollution” when waste from residential areas is washed into streams by storm water.

A further major problem is poor management of infrastructure from the level of the household to wastewater treatment plant level. Some streams in Johannesburg which would normally be dry in the winter dry season have strong flows throughout the year, indicative of sewage flows entering the storm water drainage system (see picture). This is due to household and building level plumbing failures in

densely occupied areas such as Hillbrow as well as to sewer blockages in many low income areas which cause spillages.



While major sewage works operated by Johannesburg, Tshwane and ERWAT on behalf of Ekurhuleni perform well, smaller plants in the smaller municipalities have been problematic. Emfuleni is a well known case but Mogale City is also reported to have been responsible for serious pollution incidents. A reduction in water flows into these works (by controlling leaks) would contribute to an improvement in their functioning although in many cases they need urgent amplification which requires a significant capital expenditure.

Water pollution

Water pollution from major industries is regulated by the DWA; municipalities are responsible for regulating smaller industries which discharge their waste into municipal sewers. Small-scale activity (workshops, plating shops, food outlets) if not properly regulated can cause significant pollution as well as damage to the sanitation systems.

While there is significant pressure from mining industry for assistance with pumping and treatment, it is suggested that the Province should defer to the national DMA in this regard. There may be benefit in building collective treatment capacity to serve clusters of mines on east and west rand. However, DED should be careful not to allow itself to be lobbied by mining interests to pass the (private) costs of their

waste management and closure to the public. Proposals to contract section 21 companies to undertake such work, as part of closure certification, may have that result.

(Of interest are the cost estimates produced by the McKinsey report for South Africa – see Figure 15 above. Although only indicative, they suggest that “cost-negative” interventions to meet 2030 water demand would include fitting efficient shower heads and improving operational efficiency in municipal networks (pressure management and leakage). Cost positive interventions identified included new dams, which were reported to be significantly cheaper than domestic rain water harvesting and fixing household leaks although the sanitation and educational benefits from such programmes were not costed.)

7.5.7 Recommendations

On the basis of these considerations, the main recommendations for water supply and sanitation are that DED should promote and cooperate in the following programmes:

- Water demand management, through
 - Leak control programmes, in cooperation 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
 - Joint regional strategy, to be developed with DWA and Rand Water, to review options including utility based treatment, export to water-short catchments, more rigorous control of existing mines etc.
- 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.

Once options have been chosen, the activities and projects should be outlined in more detail and their costs and potential benefits calculated.

7.6 Waste Management

7.6.1 Summary of findings

Waste to landfills can be reduced by up to 60% (3,885,702 tons / year) and over 19,400 jobs can be created.

7.6.2 Introduction

Gauteng is the largest waste producer in South Africa, currently producing over 5,7 million tons of waster per year. The average amount of waste generated in Johannesburg is approximately 1.2 kg per person per day.

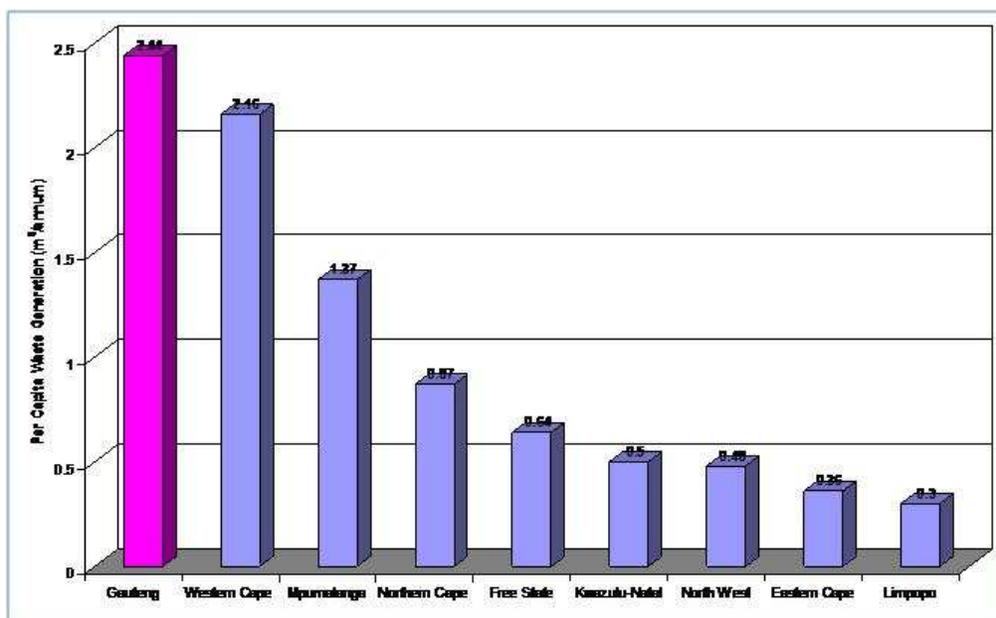


Figure 19: Provincial per capita generation of general waste (Adapted from: Gauteng State of the Environment Report, 2004)

Issues around waste in Gauteng include¹⁰⁰:

- Increasing urbanisation of Gauteng is leading to increasing waste generation.
- Increasing commercial and industrial development translates to more waste being generated by the residential, industrial and commercial sectors.
- Limited waste collection in poor areas (20% of households within the Gauteng Province do not have access to weekly refuse removal services).
- Poor enforcement of national, provincial and municipal laws and regulations.
- Lack of encouragement and awareness of waste avoidance, minimisation and recycling.
- The rising oil price increases the cost of waste transportation to landfills

This results in problems such as:

- 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.

¹⁰⁰ The two lists below are from the “GAUTENG 2055 LONG TERM DEVELOPMENT STRATEGY” for Waste Management

- 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 survey for municipalities in Gauteng reveals that non-recyclable domestic waste forms 40%, organics 15%, recyclables 25% and builders' rubble 19% of the total waste composition. Thus close on 60% of waste can easily be used for other purposes.

7.6.3 Current Gauteng Figures

The table below shows the current and future waste projections for a number of municipalities within Gauteng.

Municipality	Waste Generated (t/annum)	Waste Projections (2020)	Current Recycling Initiatives
City of Tshwane Metropolitan Municipality	2,401,840	2,733,245	Tshwane Recycling Corporative
City of Johannesburg Metropolitan Municipality	1,492,000	1,697,865	Pikitup composting, Material Recovery Facility, curb-side recycling and E-waste. Robinson's Deep Waste Flow Plant. Resource Recycling Plant in Randburg.
Ekurhuleni Metropolitan Municipality	1,368,000	1,556,756	Green Waste Minimisation Programme. Mondi curb-side recycling programme.
Sedibeng District Municipality	373,071	424,547	Waste Exchange Programme currently being developed.
Metsweding District Municipality	33,660	383,04	None currently.
West Rand District Municipality	60,949	69,359	Local initiatives currently being developed.
TOTAL	5,729,520	6,520,076	

Figure 20: Waste volumes, waste projections and current recycling initiatives for metropolitan and district municipalities in the Gauteng Province (Adapted from: The General Waste Minimisation Plan for Gauteng: Status Quo and Waste Minimisation Options Report, 2008)

7.6.4 Job creation potential

The following table shows the job creation potential of various processes:

Categories	Jobs per 10,000 TPY
Product Reuse:	
Computer Reuse	296
Textile Reclamation	85
Misc. Durables Reuse	62
Wooden Pallet Repair	28
Recycling-Based Manufacturers:	
Paper Mills	18
Glass Product Manufacturers	26
Plastic Product Manufacturers	93
Processing Facilities:	
Conventional Material Recovery Facilities	25
Plastics Processing Facilities	18
Metal Reclaimers	26
C&D Processors	93
Composting	4
Landfill and Incineration	1

TPY = Tons Per Year
C&D = Construction & Demolition

Proposed 2020 Target for waste recovery: 3,885,702 tons / year (60%)

Job creation potential: assume conservative average of 50 jobs per 10000 tons waste / year

Total job creation potential: minimum 19,400 direct jobs

The PET Recycling Company (Pty) Ltd recycled over 20,000 tons of PET bottles in 2007, or 22% of beverage PET sales. This created in excess of 10,000 informal jobs¹⁰¹.

¹⁰¹ "Development of a general waste minimisation plan for Gauteng: Status Quo and Waste Minimisation Options Report, Draft Final v3.1", 23 Feb 2009

7.6.5 Recommendations & benefits

It is our recommendation that Gauteng focus on putting in place both policies and Focus on programmes to both minimise waste at point-of consumption, reuse waste where possible, and recycle all recyclables.

- **Mandatory Recycling Efforts**

- By the year 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 minimization. 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 IWMP, 2005).

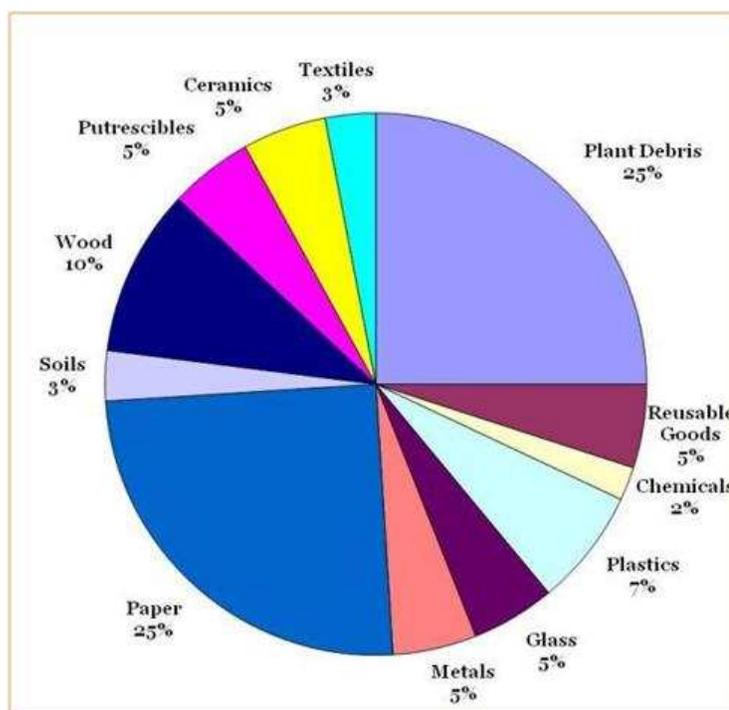


Figure 21: Recycling - The 12 Master Categories

- Currently recycling is done on a voluntary bases, the Province plans to formalize efforts to ensure that separation at source becomes mandatory. By formalizing these initiatives the amount of waste sent to landfills will be reduced which will ultimately save in high disposal costs. Furthermore, formalizing will stop current informal recycling activities. This is necessary due to the associated health risks and undignified lifestyle of informal recyclers (Z Smale 2008, *pers. comm.*, 10 September). No formal research has been conducted regarding the number of people that are involved in informal recycling. It is essential that research generating data quantities takes place to initiate the formalization of these activities.

- 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).
- The provincial directorate envisages formal Material Recovery Facilities (MRFs) could perform the dual role of reducing waste to landfill and providing a large amount of formal employment. The Provincial Waste Directorate and ultimately the national government have a large role to play in creating a market for recycled products. This can be achieved through the Gauteng Shared Services Centre (GSSC) to ensure that governmental office materials are sourced from recycled products (Z Smale 2008, *pers. comm.*, 10 September).
- Recycling has the added benefit of reducing the electrical energy required to make products, as shown in the graph following.

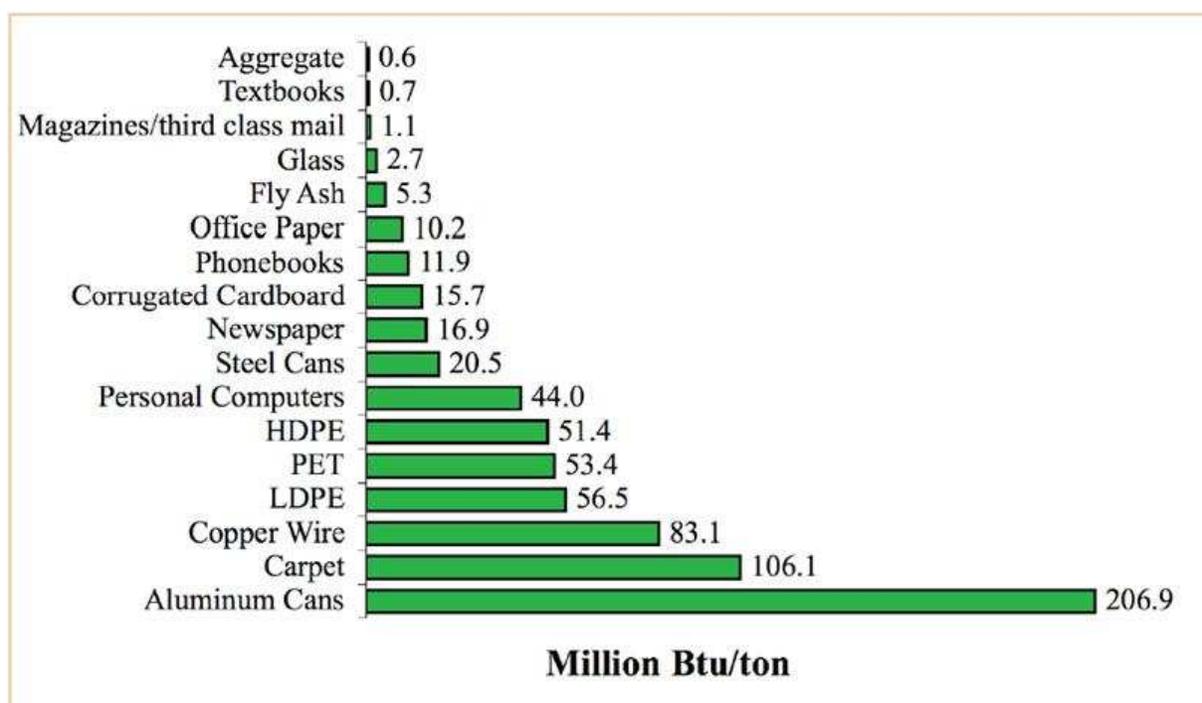


Figure 22: Energy Saving Potential per ton recycled

- **Development of Composting Initiatives**
 - Currently organic waste is disposed of in landfill sites which occupies limited valuable landfill space (Ekurhuleni Metropolitan Municipality IWMP, 2005). 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 (see Key Initiative 1 above).
- **Waste Minimization Clubs**

- This refers to initiatives whereby 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 is 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 they will produce 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 (Z Smale 2008, pers. comm., 10 September) in terms of their end uses.
 - Landfill site selection will need to be optimized such that rail can be used to move the waste to the site and thus reduce transportation costs.

7.7 Transport

7.7.1 Summary of findings

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:

15% fuel saving	0.98 million litres per day
Required # of people to switch from private car to BRT	1.1 million people
Number of BRT busses required	2400
Job creation potential (3 shifts)	7200
Estimated Subsidy	R 850 million

7.7.2 Introduction

The growth constraints and sustainability challenges in the transport sector include:

- 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 usage¹⁰².
- There is a growing tendency to move away from train and bus transport in favour of private vehicles¹⁰³.
- 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 has concerns that:

- Public transport is not readily available or is too far;
- Public transport is too expensive;
- Vehicles are not safety and drivers drive poorly

For example more than half of taxi users are dissatisfied with 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 & safe;
- Job-creating;
- Promote short distance trips;
- Be low in carbon emissions.

¹⁰² Mercer, *City of Johannesburg State of Energy Report*.

¹⁰³ Ibid.

7.7.3 Possible economic benefits and job creation potential

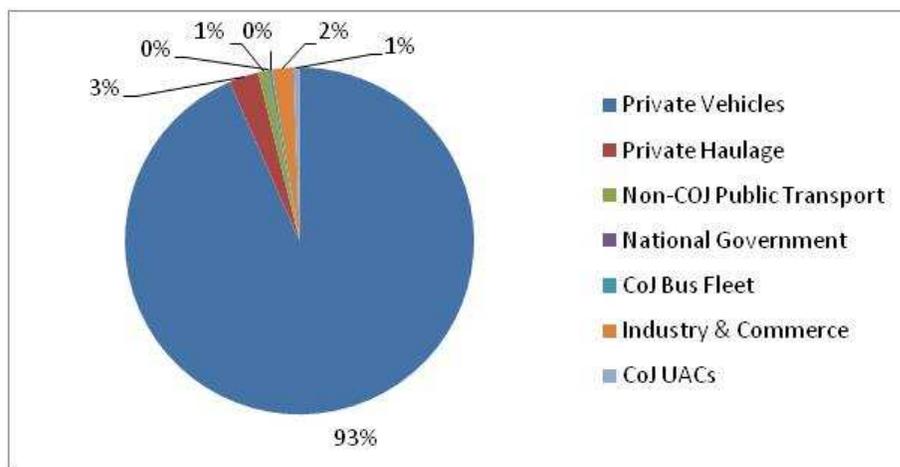
The current proposed target for “Transport Energy Efficiency” is a reduction of 15% by 2025¹⁰⁴. Simplistic view of this would be to argue for a 15% reduction in fuel consumption in the province.

Here a scenario is proposed in which there is a 15% reduction in fuel consumption in Gauteng due to a major shift from private transport to public transport, and a reduction in private kilometres driven. The savings to the economy and reduced carbon, increased energy security and job creation will be discussed.

The table below shows the 2007 fuel consumption in Gauteng. The graph following illustrates that by far the largest consumer of fuels in Gauteng is in the Private Vehicles sector.

	Diesel litres (millions)	Petrol litres (millions)	Energy (TJ)	
Private Vehicles	680.7	1699.5	84060	93.4%
Private Haulage	62.9	2.5	2483	2.8%
Non-COJ Public Transport	21.1	0.3	814	0.9%
National Government	1.3	0.4	64	0.1%
CoJ Bus Fleet	6.8	0.0	259	0.3%
Industry & Commerce	48.0	0.4	1843	2.0%
CoJ UACs	8.9	3.7	469	0.5%

In private vehicles, this equates to approximately 6.5 million litres of fuel per day.



The table below shows the average fuel consumption per person per 100 km travelled¹⁰⁵.

¹⁰⁴ Dept of Local Gov & Housing, *Gauteng Integrated Energy Strategy*.

¹⁰⁵ Mohammed and Venter, *Analysing Passenger Transport Energy Consumption from Travel Survey Data*.

	litres/100km/veh	Avg # Occupants per vehicle	litres/100km /person
Non-motorised	0	1	0
Motorcycle	2.8	1	2.8
Motor car	10.8	2	5.4
Minibus Taxi	10.3	9.3	1.107526882
Bus	47.5	33	1.439393939

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.

The following table shows the average travel distance, time and speed by car and bus¹⁰⁶. The table and the report show that there are not significance differences between the two.

	Average Distance	Average Time	Average Speed
Private Vehicle (Home -> Work)	9.94 km	18 min	33.1 km/h
Bus (Home -> Work)	10.14 km	22 min	27.7 km/h

Assuming the following:

- the average distance travelled is 10 km;
- a switch from private car to BRT will save 4.3 litres per person per 100km travelled;
- average number of trips per day is 2.

We can then make the following calculations of how many people would need to switch from private car to BRT, now many jobs it would create, and what subsidy would be required.

¹⁰⁶ STEWART SCOTT, *Technical Report GAUTENG TRANSPORT STUDY (GTS) MODAL SPLIT*, 30.

1 person car -> taxi/bus	4.3	Litre savings per 100km/vehicle
Average Trip distance	10	km
Number of trips per day	2	
Fuel saved per trip	0.43	litres saved per trip
Fuel saved per person	0.86	litres per day per person
Daily fuel consumption	6.5	million litres per day
15% fuel saving	0.98	million litres per day
Number of people to switch	1.1	million people
Current BRT daily passengers¹⁰⁷	69300	estimated passengers per day
Current Number of busses	960	
Passengers per bus	72	
Trips per passenger	2	trips / passenger
People per bus per day	480	people / bus / day
Annual subsidy	R 340	million
Subsidy per person per day	R 13.44	
Number of busses required	2400	
Job creation potential (3 shifts)	7200	
Estimated Subsidy	R 850	million

As can be seen, a shift to large scale BRT to meet the energy efficiency target for transport could create over 7200 direct jobs.

7.7.4 Recommendations

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

- Promote a major shift from private to public transport
- Increase in quality, affordability and availability of public transport
- City planning should shift from road-driven infrastructure development to rail, bicycle and pedestrian driven infrastructure development. This will require that work, home and schools be brought closer together.

Further work in this should be done in a broader scoped strategy study.

¹⁰⁷ Figures from a Bus Rapid Transit in Gauteng presentation.

8 Other Suggested Initiatives

Some options that are considered to have good job creation potential have been explored above. A number of other short, medium and long-term options are included in a more detailed list of options below. It is recommended that the other items be explored in due course. We have proposed a wide range of possible approaches: the task of government is to assess these, select and prioritise its policy choices, after which detailed research, planning, programme design and implementation will follow.

8.1 Short-term

- Policy changes to promote low-carbon, high employment;
- Create a “Green Gauteng” brand to attract investment;
- **Drive initiatives for local food production;**
- **Drive initiatives for Energy Efficiency;**
 - Residential, Commercial, Industrial;
 - Public lighting – road lights, traffic lights;
 - Minimum efficiency standards.
- **Promote and assist with finance and skills for Solar Water Heaters;**
- **Compulsory Waste Management and Recycling¹⁰⁸;**
- Promote investment in ecosystem services – water, food, forests, parks, etc. ;
- **Invest in water management & recovery;**
 - Water loss reduction;
 - Grey Water systems;
 - Mines water management and clean-up.
- Forestry & Agriculture;
 - Promote planting of trees;
 - Use of organic or low-fossil fuel content fertilisers.
- Fuel switch from electricity to Liquid Petroleum Gas (LPG) for cooking/heating;
- Promote Smart Metering in building to assist with Demand Side Management;
- Promote investment into local development of new Battery and Storage technologies¹⁰⁹;
- Indoor building air quality = improved worker health and productivity;
- Public open space / “greening”;
- Energy projects;
 - Landfill Gas;
 - Waste-to-energy;
 - Biogas;
 - Sustainable Biofuels.

¹⁰⁸ See <http://www.izwa.org.za/>

¹⁰⁹ Venter, “SA is gearing up to produce batteries for electric vehicles.”

8.2 Medium-term

- Concentrated solar plant industry;
 - R&D;
 - Component Manufacturing;
 - Attract foreign technology companies.
- Green Integrated Development Zone;
 - For Concentrated Solar Power and/or other green technologies.
- Transportation;
 - Shift to rail, BRT, low carbon vehicles;
 - Fewer highways;
 - Penalise/tax private car use.
- Sewerage reduction and sewerage-to-energy;
- Large scale Urban food production;
- Smart Grids Infrastructure;
- Compulsory Green Building standards;
- Mining Sustainability Programme, incorporating:
 - R&D into clean mining technology;
 - Restoration on damage ecosystems;
 - Water management;
 - Solar Water Heaters;
 - Energy Efficiency;
 - Renewable Energy generation.

8.3 Long-term

- Cities as net ecological service providers reducing the need for imported services like food and water;
- Major Renewable Energy Manufacturing Infrastructure, especially Concentrated Solar Power (CSP).

8.4 Summary

The table below gives a summary of each of the initiatives proposed above and ranks them against a number of economical, social and ecological benefits.

	*** = Excellent; ** = Good; * = Poor; N/A = Not applicable													
	Economic Benefit					Social Benefit			Ecological Benefit					
	GDP	Direct Job Creation	Indirect Job Creation	New Industry	Local content	Investment	Innovation	Security	Health	Happiness	Climate Adaptation	Climate Mitigation	Resource Decoupling	Responsible Agent
Short-Term														
Policy changes to promote low-carbon, high employment	*	N/A	N/A	*	**	**	N/A	N/A	N/A	***	*	N/A	N/A	DED
Create a "Green Gauteng" brand	*	*	*	N/A	N/A	N/A	N/A	N/A	N/A	***	*	N/A	N/A	GPG, GEDA
Drive initiatives for local food production	***	***	***	*	***	**	*	***	***	***	***	**	**	GDACE, Local sphere, NGOs
Drive initiatives for Energy Efficiency	**	*	**	*	*	**	*	*	*	*	**	*	**	Dpt Energy, pronical/local spheres, ESKOM, GEDA, Innovation Hub (Blue IQ), Dpt LG
Promote, finance and skills for Solar Water Heaters	**	*	**	*	***	**	*	*	**	*	*	**	**	DED, local sphere. CEP, GEDA, DLG, Blue IQ
Compulsory Waste Management and Recycling	**	**	*	*	***	*	*	N/A	**	**	*	*	**	DWAF, local sphere, CEP, GDACE, DLG
Promote investment in ecosystem services	**	*	**	**	**	*	**	*	*	*	*	**	**	DED, GEDA
Invest in water management & recovery	***	*	*	*	**	*	*	N/A	*	**	*	**	**	
Forestry & Agriculture	*	*	**	*	**	*	*	N/A	*	**	*	*	*	
Switch from electricity to LPG for cooking/heating	*	*	N/A	N/A	*	*	*	*	*	**	*	*	*	
Smart Metering	*	*	N/A	***	**	*	***	*	N/A	N/A	N/A	*	N/A	
New Battery and Storage technologies	**	*	*	***	*	**	***	*	N/A	N/A	N/A	*	N/A	
Indoor building air quality	*	*	*	*	*	*	*	N/A	N/A	**	N/A	N/A	N/A	
Public open space / "greening"	*	*	**	*	***	*	*	N/A	**	***	**	*	*	
Renewable Energy projects	*	**	***	**	*	***	***	**	*	**	*	***	**	Dpt Energy, Province/loca, City Power
Medium-term														
Concentrated solar plant industry	**	*	**	***	***	***	***	***	*	*	*	***	**	DED
Green Integrated Development Zone	**	*	**	**	***	**	**	N/A	*	*	**	*	***	DED
Transportation	**	**	**	*	*	*	**	N/A	*	**	**	**	**	DoT/DED
Sewerage reduction and sewerage-to-energy	*	*	N/A	N/A	**	*	*	**	*	*	*	**	*	Local
Large scale Urban food production	**	***	***	*	***	**	*	***	**	***	***	**	**	GDACE, local
Smart Grids Infrastructure	*	*	*	**	*	*	**	**	*	*	*	*	N/A	Dpt energy, DED, local
Compulsory Green Building standards	*	*	**	*	***	*	*	*	**	**	*	*	N/A	Local sphere
Mining Sustainability Programme	**	**	*	**	*	**	*	*	**	**	*	**	*	Dpt Mining, DTI, DED
Long-term														
Cities as net ecological service providers	**	**	***	***	***	**	***	***	**	***	***	*	***	All
Major Renewable Energy Manufacturing Infrastructure	***	*	*	***	***	**	***	***	*	**	*	***	**	National & provincial spheres

Figure 23: Table of Possible Initiatives and Ratings

9 Conclusions

“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. ... Just as the revolution in information and communication technologies provided a major motor of growth over the past 30 years, the transformation to low-carbon technologies will do so over the next. It is unsurprising, therefore, that over the past year governments across the world have made green investment a major part of their economic stimulus packages. They have recognised the vital role that spending on energy efficiency and infrastructure can have on demand and employment in the short term, while also laying the foundations for future growth.” Gordon Brown, Time Magazine, 28 September 2009

In this preliminary strategy document, the need for a green low-carbon economy has been introduced. There are significant new challenges arising from ecological constraints to the business-as-usual approach to growing economies. To realign economies to focus not only on GDP, but also long-term sustainability, job creation and “happiness” will require a shift capital-focussed investment to strategic investments in knowledge capital and innovation systems. New skills will need to be developed in the areas of solar water heaters, local food production, urban agriculture, energy audits, and new investments will need to take place into infrastructure and planning around water, transportation and renewable energy production, especially solar.

Gauteng can play two main roles in this space:

1. “A **facilitator role** for information sharing, through the support to formal inter-organizational networks, and through the facilitation of informal knowledge spillovers, and
2. **An enabler role**, through the identification of priority areas for investment in science, technology and development and well-designed support for R&D and education.”¹¹⁰

Additional research is needed to flesh out what a broad green economy could look like for Gauteng. This would require a number of additional processes, including:

- Interaction with a visits to regions and cities that are currently implementing green economy strategies, especially South Korea;
- Further research work into the items proposed, particularly around the inter-linkages of challenges (such as food and water);
- Inter-departmental and cross-cutting initiatives in green strategy;

¹¹⁰ Kamal-Chaoui and Robert, *Competitive Cities and Climate Change - Regional Development Working Papers N° 2*, 155.

- Promoting a change in thinking that puts the poor and most vulnerable first while addressing the ecological challenges the face us. This will need to be communicated across all departments, all levels of government, and to business and trade-unions.

These challenges that face us are immense but not unconquerable. It will take much hard work and co-operation across the spheres of governments to solve them. The alternative in the long run is that the poor with suffer and growth will falter, whereas if action is taken now, the economy will grow, but using less resources and with less environmental impact.

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11 Appendix B: Additional Comments on the Economic Crisis and Ecological Limits

“There is a broad global consensus that we face the unprecedented twin challenge created by inter-linked economic and environmental crises”¹¹¹

One of the root causes of the economic crisis was that financial risk was not correctly priced by banks, especially in the US housing market. When the economy slowed, these risks came back to bite not only the bankers who were profiteering off the low priced risk, but the entire economy that the banks supported.

Likewise the ecological risks that face us both in the short and long term are not being factored into the way we conduct business and will indeed come back to bite us in due course.

“The ruin of the financial markets and economy can, even with great difficulty, be overcome - a planet ruined by climate change cannot.” Prof. Klaus Töpfer, member of the German Council for Sustainable Development & Former Executive Director of the UNEP.

In a country and province facing severe challenges of poverty coupled to growing levels of protest regarding access to basic services – clean water, sewerage, refuse removal and so on, on top of the lack of jobs – the political costs of the ecological crisis should not be under-estimated. Those costs will be far higher than any possible resistance from (dirty) sectors of the economy that may feel threatened by greening.

¹¹¹ Swilling, *Growth, Resource Use and Decoupling: Towards a ‘Green New Deal’ for South Africa*, 1.

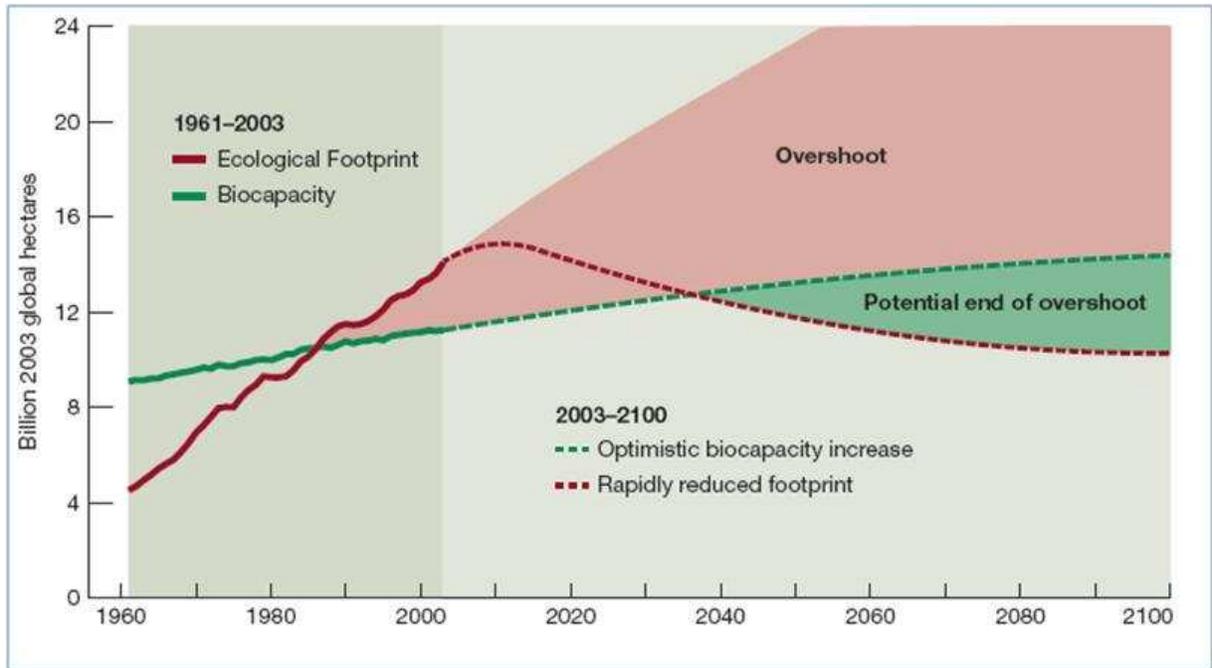


Figure 24: Ecological footprint vs biocapacity

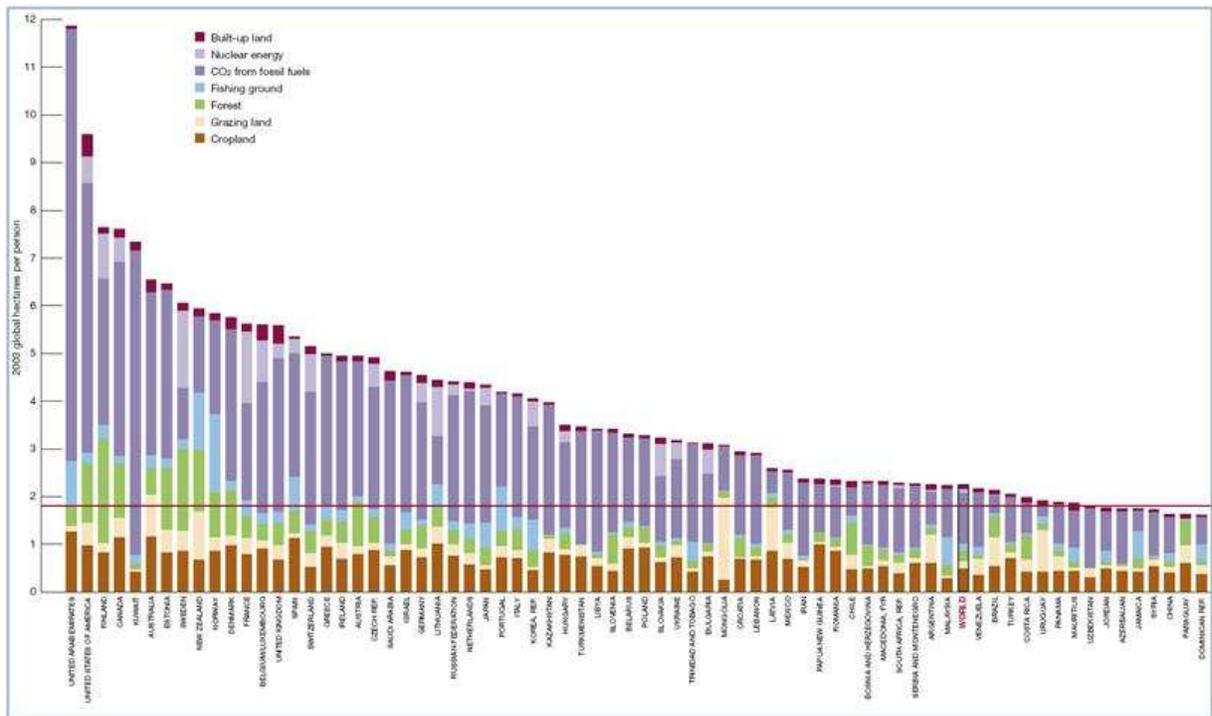


Figure 25: Ecological Footprint by country compared to world and sustainable average

The risks associated with the degradation of the ecological systems that support us must be addressed. We should be as clear about the social and political risks, as we are about the ecological and economic risks. It

requires us to decouple economic growth from resource consumption. This simple-sounding phrase is at the heart of the mindset change that is required. Some of these risks are discussed briefly below.

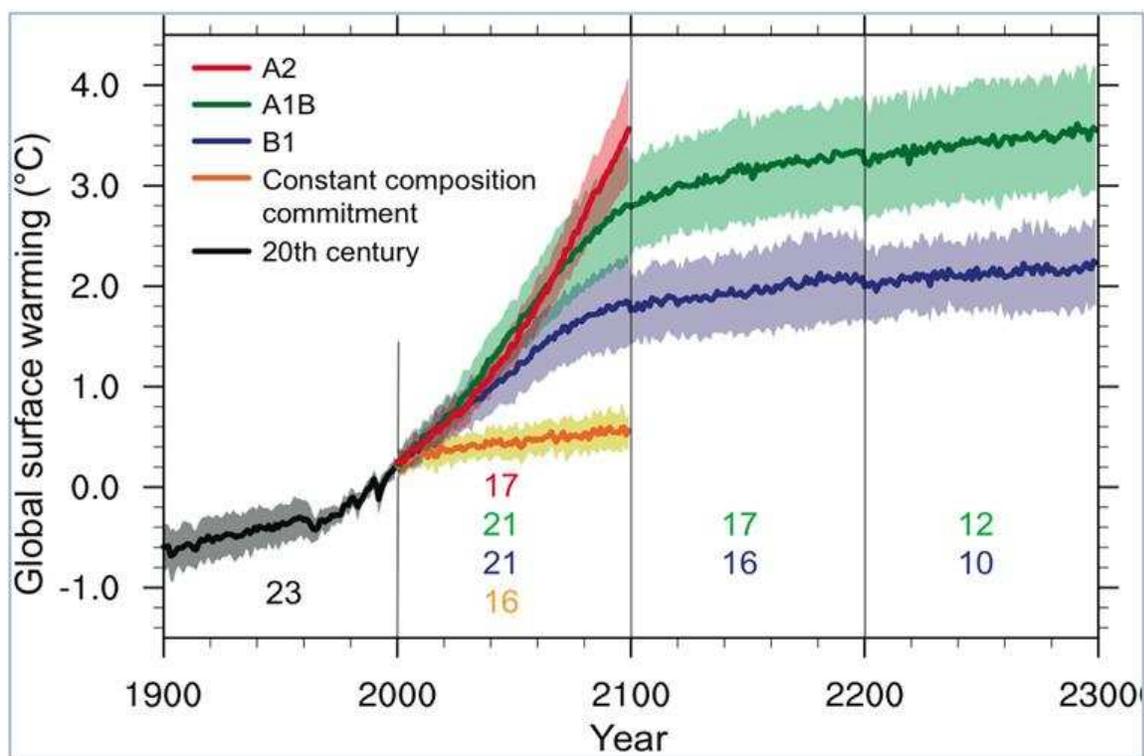
11.1.1 Climate Change

The Fourth Assessment Report (4th AR) of the Intergovernmental Panel on Climate Change (IPCC) published in 2007¹¹² basically confirmed the general trends of the previous Assessment reports, namely that global temperatures are rising, and that these temperature increases are due to an increase in concentrations of greenhouse gases in the atmosphere caused by human activities (Intergovernmental Panel on Climate Change 2007). The International Energy Agency forecasts that if policies remain unchanged, world energy demand is set to increase by 45% by 2030 (International Energy Agency 2008). At the same time, the IPCC has warned since 1988 that nations need to stabilise their concentrations of CO₂ equivalent emissions, requiring significant reductions in the order of 60 percent or more by 2050. In the latest 4th Assessment, the IPCC argues that dangerous climate change global emissions need to start to decline no later than 2012-13 and that by 2020 global cuts of 25-40 per cent are needed. By 2050, at least 80 per cent cuts are needed. The main human activities that have resulted in a 70% increase in greenhouse gas emissions since 1970 are the burning of fossil fuels, deforestation, and agricultural production. The projections for the future suggest that even if we act now to build low-carbon economies, temperatures will still rise by 2 degrees (blue line in Table below). If we make moderate changes along the lines envisaged by the Kyoto Protocol, we could face runaway global warming with devastating consequences (green line, and possibly the red line, in the Table below). Either way, it may be worth quoting a conservative source on the impact on the poor, namely Sir Nicholas Stern¹¹³ who wrote in his report to the UK Government:

“All countries will be affected. The most vulnerable – the poorest countries and populations – will suffer earliest and *most*, even though they have contributed *least* to the causes of climate change.” (Stern 2007)

¹¹² . 4th Assessment Report was awarded the Nobel Peace Prize in 2007, together with Al Gore for his documentary *The Inconvenient Truth*

¹¹³ . Sir Nicholas Stern is a former Chief Economist of the World Bank, and was commissioned to write this report on the economics of global warming by Gordon Brown when he was still Chancellor of the Exchequer.



(Source: Intergovernmental Panel on Climate Change 2007)

However, the 4th AR has significance for this discussion of sustainability for two particular reasons. The first relates to its dire predictions for Africa, the continent least equipped to respond. The second relates to the admission that the solutions go beyond the scope of climate science.

The 4th AR suggests that the African continent, which has contributed least to global warming, will be drastically affected by climate change. The main findings are that between 75 and 250 million people will suffer the consequences of increased water stress by 2020; by the same date productive outputs from rain-fed agriculture could drop by 50% with obvious negative consequences for food security; by the end of the c. 21st sea-level rise will have negatively affected most of the low-lying coastal cities around the coast of Africa; and by 2080 arid and semi-arid land areas will have increased by between 5% and 8%. There is little evidence that researchers and decision-makers in Africa have registered the full implications of the multiple impacts of global warming for the way development policies are designed in Africa.

The 4th AR has made it clear that climate policy alone will not generate the required solutions. Making a clear link to the structure of the global economy and national economies, the 4th AR argues that unless economic development policy choices are informed by the need for both mitigation (of GHG emissions) and adaptation (to the consequences of global warming), current trends and associated negative feedback loops will continue well into the future. **In short, authentic sustainable development is seen as the key to significant climate change solutions.** In particular, this will mean reviewing the regulation, financing, monitoring and strategic management of key economic sectors, in particular energy, forestry, agriculture, transport, construction and bulk urban infrastructure (water, sanitation, roads, energy, and solid waste).

Once again, these sectors are dominated by large corporates configured as a set of value chains that are designed, specified, financed and managed by people trained to think in ways that reinforce the logic of these value chains, and their personal material interests are tied to tried and tested technologies embedded in these systems. Changing these sectors is, therefore, far easier said than done. **Change, when it comes, will be the outcome of some intense power struggles waged by a wide range of socially, economically and spatially constituted interests** who will all be differentially affected by the increasingly serious ecological crises the will unfold as they discuss and negotiate. Sedate roundtable stakeholder discussions will play a role, but the real action will lie in other terrains of contestation and competition.

Although the Stern Report already cited preceded the 4th AR, it introduced a new principle into the discourse on sustainability. Basically, the Stern Report argued that it will be cheaper to fix the problems now rather than later because the later they are addressed, the greater the scale and complexity of the problems that will require remediation. The Report recommended a commitment of 1% of global GDP to finance the changes that are required. Although this is substantial, the Report argued that this is preferable to losing between 5% and 20% of global GDP if nothing is done. This may be why global elites and climate scientists talk about an annual expenditure of \$200 billion to finance mitigation.

11.1.2 Peak Oil & Coal

Although roundly criticised by the climate change community who argue we will run out of atmosphere before we run out of oil, the so-called “peak oil” community are convinced that we either have already - or will soon - hit what they define as peak oil production (Alekkett and Campbell 2003; Campbell 1997; Darley 2005; Deffreys 2001; Goodstein 2005; Heinberg 2003; Kunstler 2005; Roberts 2005; Strahan 2007).

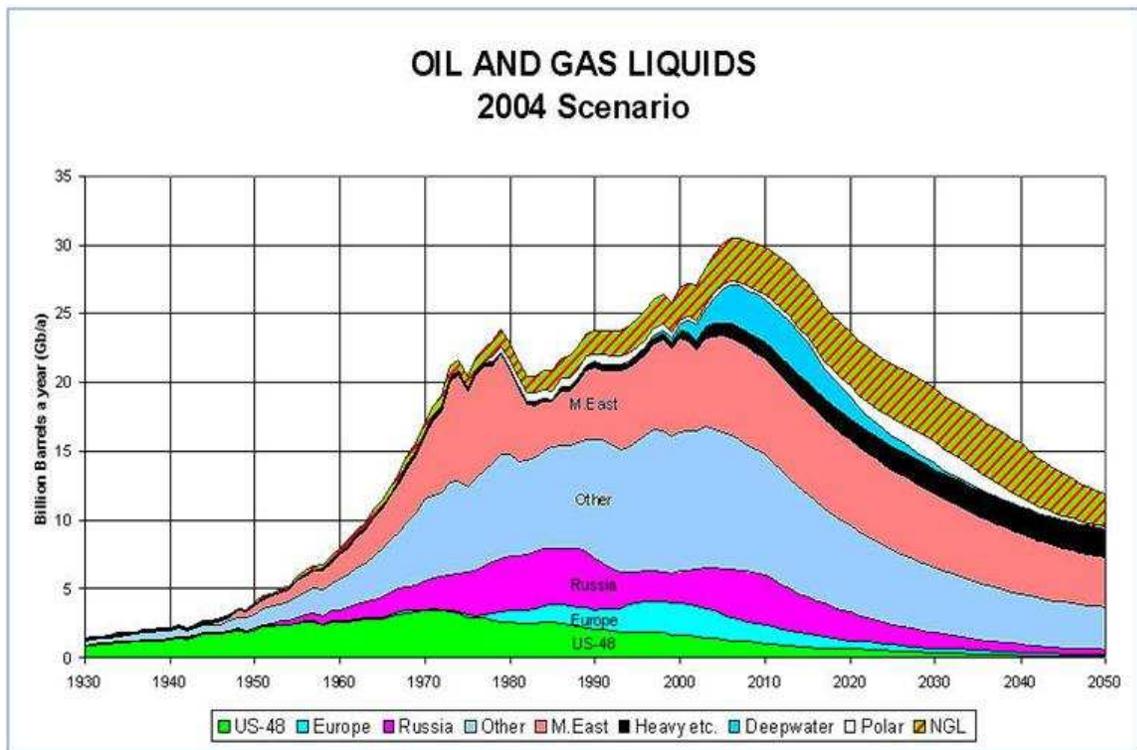
The notion that there is a point in the cycle of oil discovery and production that can be defined as a “peak” is derived primarily from the experience of oil discovery and production in the US context, but also other national contexts (e.g. the Russian and North Sea oil fields). Oil discovery in the US peaked in the 1930s and production peaked 30 to 40 years later. The oil peak protagonists basically use the same time frames to predict global oil peak. In other words, we know when oil discovery peaked globally (in the 1970s/early 80s), which means the production peak should be some time during the decade after 2005.

What is interesting about peak oil production is that it is only possible to determine whether production has peaked with hindsight. In other words, in the year that production peaks it is highly unlikely that oil companies will tend to predict a decline in the following years. Even if production does decline the following year, this could be seen as a one to three year blip – it has happened before. In 2008 the price of oil shot up to \$140/barrel. Sign of the peak? Another blip? Driven by speculators? The debate goes on, but while it does higher oil prices make possible the capture of very expensive resources such as residues in old oil wells (that were too expensive to pump when prices were lower), tar sands, deep sea deposits and, as

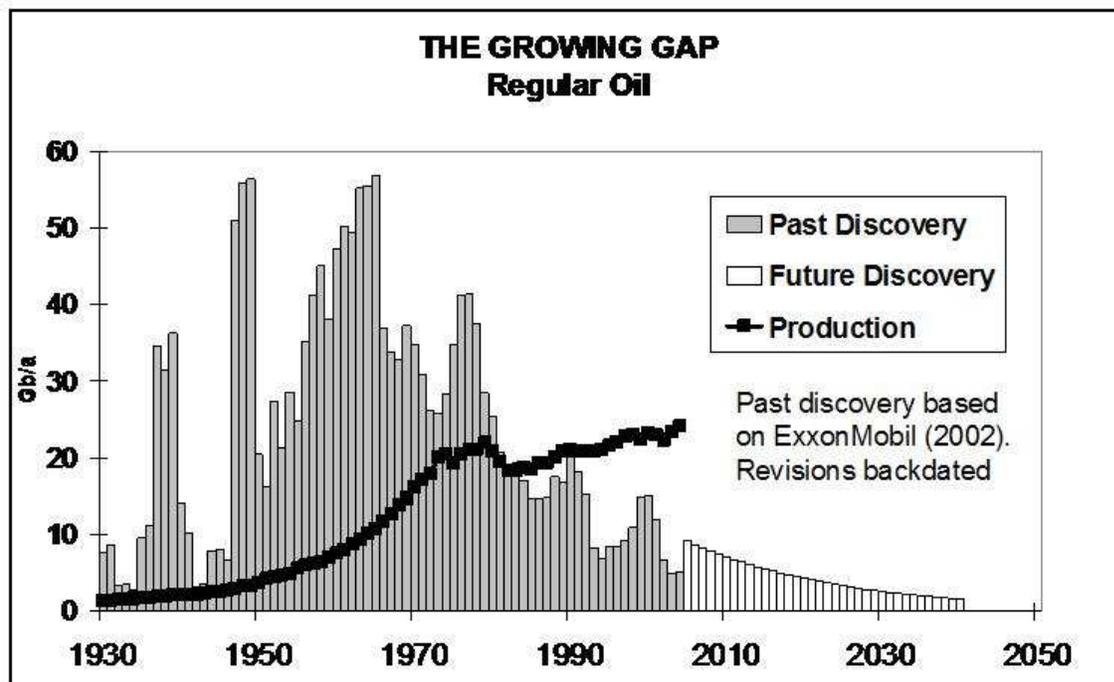
the ice melts, oil under the polar ice caps. The sceptics use these kinds of market dynamics to raise questions about the validity of predictions that we have either hit or are about to hit oil peak (Lynch 2003).

But the point is that oil is increasingly scarce and will be increasingly expensive, with enormous economic consequences. Oil prices are rising as demand outstrips supply and even oil companies advertise the end of cheap oil and the coming post-oil era. Although peak oil is the cause of much alarm in developed economies, it could spell disaster for emerging economies who have managed to find ways against all odds to play the economic growth game (for an application to the South African case see Wakeford 2007; Association for the Study of Peak Oil and Gas - South Africa 2007).

The Graphs below reflects the latest predictions from the Oil Peak Analysis Centre for peak oil production if all existing conditions remain equal. Basically, supply of oil and other fossil fuels will begin to fall off from around 2010. This as argued will put dramatic pressure on the oil price as demand will certainly continue to rise.



(Source: www.peakoil.net)



(Source: www.peakoil.net)

It is important to emphasize that 'peak oil' does not mean the 'end of oil' as implied by some of the more hysterical voices. The most significant consequence of 'peak oil' is the inevitable rise in the price of oil, despite increased investment to expand capacity. Based on a survey of 800 of the world's top oil wells, the International Energy Association reversed its long-held view that peak oil is a myth by admitting that conventional crude oil production is going to peak sooner rather later (see Figure below). Its 2008 *World Energy Outlook* reluctantly concluded that "it is becoming increasingly apparent that the era of cheap oil is over." (International Energy Agency 2008: 15) With this simple little sentence, the body that represents the mainstream views of the oil industry told the world that everything we take for granted in everyday life will be quite fundamentally transformed.

And yet cheap oil meets 60% of the world's energy needs, with no sign that anyone is taking seriously the IEA's calls for rapidly up scaling investment in more oil discovery and production. Production seems to have levelled off at around 85 million barrels per day. The long-term consequences will be felt by everyone. Oil has become ubiquitous in so many different ways. Most people simply think of fuel for motor vehicles when they think of oil, but few realise that most of the polymer that goes into the plastics we depend on are derived from oil¹¹⁴, as are most anti-biotics, the energy that is used to produce the cement that is used to build modern towns and cities¹¹⁵, nearly all the fertilizers and herbicides that are used to grow our food on commercial farms around the world, and many countries burn oil to generate electricity. Rapid

¹¹⁴ . Examples include nearly all middle class household consumables, as well as packaging, bottles for various liquids, an increasing percentage of motor vehicles, clothing, and an increasing percentage of built structures.

¹¹⁵ . Lime dug out from the earth's crust is what is used to produce cement in kilns that need to be heated up to 2000 degrees centigrade. Oil and coal are the primary resources used to heat up the kilns.

transportation of people and goods over short and long distances is assumed to be a cornerstone of the globally connected economy – without cheap oil, this would be impossible.

In addition, through technologies developed by the likes of SASOL, coal can be turned into oil, thus the coal price has become linked with the oil price. As the days of cheap oil are over, so are those of cheap coal, a core driver of cheap electricity in South Africa.

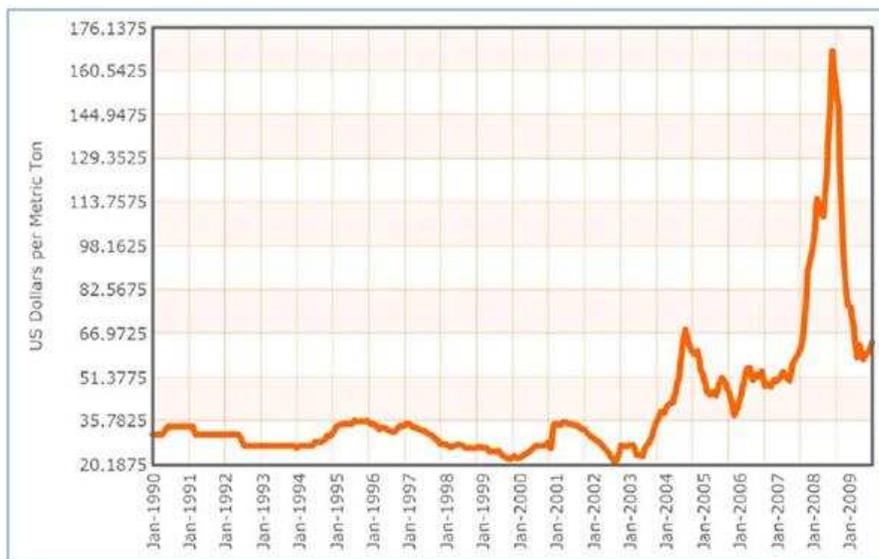


Figure 26: Historical Price Trends for South African Coal¹¹⁶

11.1.3 Soils

The International Assessment of Agricultural Science and Technology for Development (IAASTD) was released after a final plenary meeting that took place in Johannesburg in 2008 (Watson et al., 2008). It was co-sponsored by an impressive alliance of multi-lateral institutions, namely FAO, GEF, UNDP, UNEP, UNESCO, World Bank and the WHO. It initially included representatives from the GM seed industry, but these companies withdrew when the scientists and researchers came to conclusions that were not in line with what the GM seed industry would have liked. Although it paints a complex picture, there are basically four important issues at stake: increasing demand for a wider range of products as the global middle class expands, increasing food prices, worsening malnutrition in developing countries (if China is excluded), and degrading soils and related eco-system services. It is worth quoting a key finding in full:

“Quantitative projections indicate a tightening of world food markets, with increasing resource scarcity, adversely affecting poor consumers. Real world prices of most cereals and meats are projected to increase in the coming decades, dramatically reversing trends from the past several decades. Price increases are driven by both demand and supply factors. Population growth and strengthening of economic growth in sub-Saharan Africa,

¹¹⁶ IndexMundi, “Coal, South African export price.”

together with already high growth in Asia and moderate growth in Latin America drive increased growth in demand for food. Rapid growth in meat and milk demand is projected to put pressure on prices for maize and other coarse grains and meals. Bioenergy demand is projected to compete with land and water resources. Growing scarcities of water and land are projected to increasingly constraint food production growth, causing adverse impacts on food security and human well-being goals. Higher prices can benefit surplus agricultural producers, but can reduce access to food for a larger number of consumers, including farmers who do not produce a net surplus for the market. As a result, progress in reducing malnutrition is projected to be slow.”

(Watson et al., 2008: Ch. 5, p.3)

According to the report (Watson et al., 2008: Ch. 3, p.3), over 800 million people are malnourished (and this is projected to increase) and they live predominantly in developing countries; while 1.6 billion are overweight, live mainly in developed countries and suffer the consequences of over-eating (diabetes, heart disease) with major implications for health care expenses in these countries.

As **Figure 11.27** reveals, rising oil prices, driven in part by the early effects of the oil peak syndrome, have been a key driver of rising food prices. The reason for this is that modern agriculture depends heavily on chemical inputs derived from oil and supplied by a small handful of global chemical companies. This is true for almost all agriculture in developed countries, and for 40% of the 437 million farms in developing countries that support the livelihoods of 1.5 billion rural dwellers (Madeley, 2002: 21). Chemical fertilizers, together with irrigation, hybrid seeds and micro-credit, formed the mainstay of the so-called Green Revolution that transformed agricultural practices on a global scale (with India leading the way) from the 1960s onwards (but starting off mainly in the USA in the 1930s).

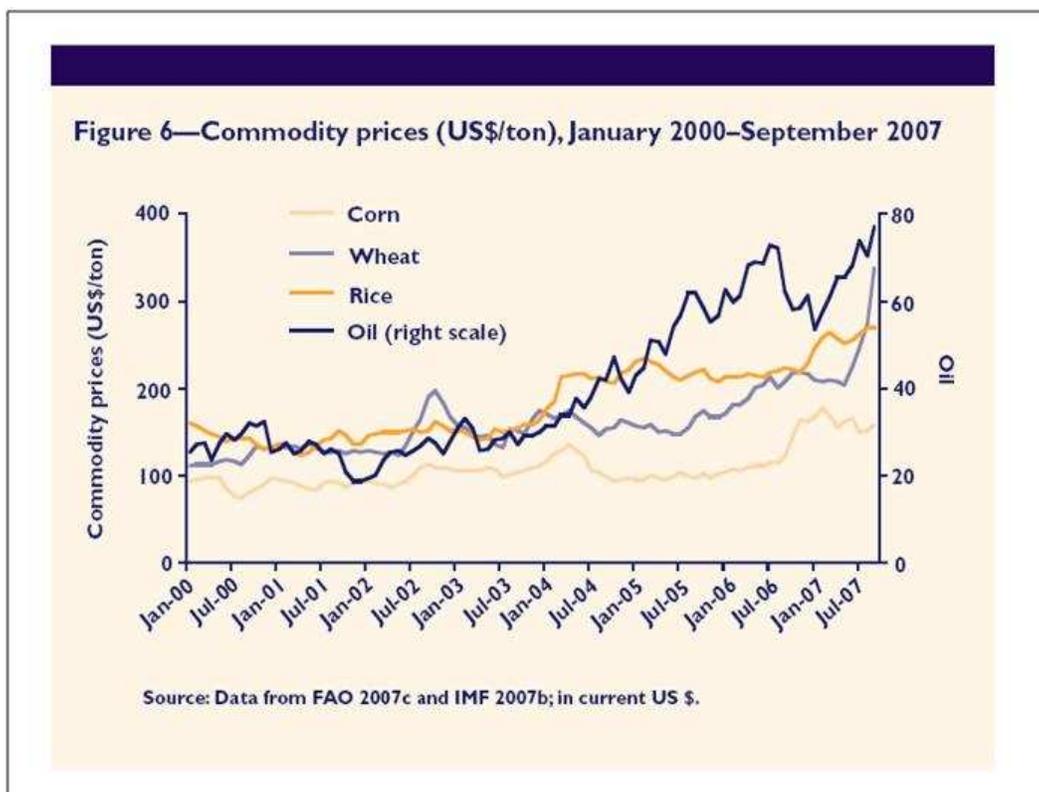


Figure 11.27. Commodity prices (US\$/ton), January 2000 - September 2007

(Source: Von Braun 2007: 1)

It would, however, be incorrect to focus purely on oil prices and growing consumer demand to explain the crisis of rising food costs and the related decline in food security. This, indeed, has been the focus of the global media and policy community during the course of 2008 when this crisis hit headlines as food riots broke out across the globe. What lacks adequate discussion is the impact that rapidly degrading soils are having on supply.

It is obvious that if soils are degrading, this must in some way contribute to rising prices because supply is negatively affected. Despite this logic, this connection is hardly ever mentioned in the recent research and policy literature on the food crisis. The IAASTD refers to the problem when it points out that “23% of all used land is degraded to some degree” (2008: Ch.1, 73) and it goes on to suggest that “declining soil fertility” (2008: Ch. 3, p.4) is the major challenge for agricultural science. The report states that:

*“Agricultural use of natural resources (soils, freshwater, air, carbon-derived energy) has, in some cases, caused significant and widespread degradation of land, freshwater, ocean and atmospheric resources. Estimates suggest that **resource impairment negatively influences 2.6 billion people.**”*

(Watson et al., 2008: Ch. 3, p.3 - emphasis added)

The notion that “resource impairment” [read: unsustainable resource use] affects 2.6 billion people is a truly remarkable statement of the immense dimensions of the crisis that the agricultural socioecological system is actually facing, and puts into perspective the role that degrading ecological resources play in driving up food prices. According to Scherr (from the Washington-based Institute for Food Policy Research), although 23% of “all used land” was degraded by the 1990s (using the FAO figures that the IAASTD also used), 38% of all “agricultural land” was degraded (see Table below). However, conditions are a lot worse in Africa where 65% of all “agricultural land” was degraded by the 1990s, second only to Central America where the figure was 74% (Scherr, 1999: 18). This explains why 26 million hectares of land in Africa have been abandoned by farmers in the thirty years leading up to 2000 as huge quantities of N, P and K have been stripped from the soils (Gruhn et al., 2000: 11).¹¹⁷ This despite the fact that 50% of all fertilizer in Africa comes in free of charge as aid and 22 out of 40 countries get all their fertilizer for free (Gruhn et al., 2000: 12). Maybe it is time to ask whether free fertilizer provision in Africa might actually be one reason why so much African land is being degraded and abandoned. Now Western Governments via their aid programmes are punting a new “total solution”, namely GM seed.

11.1.4 Biodiversity and Ecosystem Services

The Millenium Ecosystem Assessment (MEA) referred to at the outset of this chapter is one of the great iconic documents of our time (this, despite the fact that hardly anyone beyond the environmental sciences has ever heard of it). The significance of the MEA lies not in its rather weak policy prescriptions¹¹⁸, but rather because it is the first comprehensive analysis of the relationship between what it refers to as “human well-being” and “ecosystem health”. Called for in 2000 by the UN Secretary-General Kofi Annan, initiated in 2001 and funded by the UN Foundation with a USD24 million grant, it reported in 2005. The report was a remarkable global collaboration between 1360 experts from 95 countries. The research and results were peer reviewed by specialists drawn from UN agencies, Universities and research institutes from across the world. The MEA report used the following graphic to capture the relational transdisciplinary nature of its analytical focus:

¹¹⁷ To this in perspective, South Africa has a total of 14 million hectares of agricultural land of which only 3% is high value land. 26 million hectares is therefore nearly twice the land available in South Africa.

¹¹⁸ . Unfortunately, and surprisingly, these prescriptions are informed by a naive form of market economics. It is puzzle why the more mainstream perspectives of institutional economics were not used to frame the economic policy proposals.

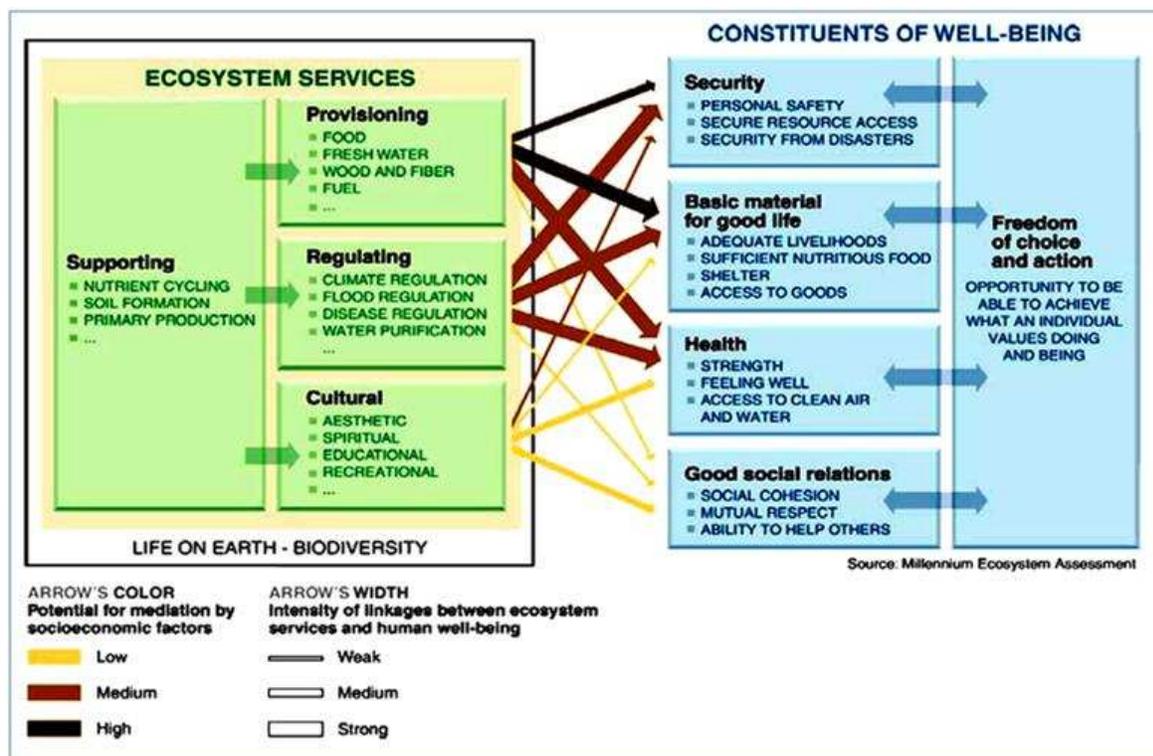


Figure 28: Ecosystem Services

As represented in the graphic, the MEA analysed the following “ecosystem services” that socio-economic systems depend on:

- Provisioning services: food (crops, livestock, capture fisheries, aquaculture, wild foods); fiber (timber, cotton, hemp, silk, wood fuel); genetic resources; biochemicals, natural medicines, pharmaceuticals; water
- Regulating services: air quality; climate regulation (global, regional and local); water regulation; erosion regulation; water purification and waste treatment; disease regulation; pest regulation; pollination; natural hazard regulation
- Cultural services: spiritual and religious values; aesthetic values; recreation and ecotourism
- Supporting services: nutrient cycling; soil formation; primary production

The MEA’s four main findings were the following:

- Over the past 50 years humans have changed ecosystems more rapidly than ever before in human history to meet demands for food, fresh water, timber, fibre and fuel. This has caused substantial and “largely irreversible loss in the diversity of life on Earth”.
- Although ecosystem change has contributed to gains in human well-being, the costs are degradation of ecosystems, increased risk of non-linear changes, and increased poverty.
- Degradation will get worse over the next 50 years and is a barrier to achieving the Millennium Development Goals (MDGs).

- Reversing ecosystem degradation is possible, but will require “significant changes in policies, institutions and practices”

Some examples of the conditions referred to in the MEA include:

- 60% (or 16 of the 24) of the world’s ecosystem services have been degraded or are used unsustainably;
- about a quarter of the Earth's land surface is now cultivated;
- people now use between 40 percent and 50 percent of all available freshwater running off the land - water withdrawals have doubled over the past 40 years;
- since 1980, about 35 percent of mangroves have been lost;
- about 20% of coral reefs were lost in just 20 years, and 20% degraded;
- nutrient pollution (generated mainly by chemically produced materials) has led to eutrophication of waters and coastal dead zones;
- species extinction rates are now 100-1,000 times above the so-called background rate.

Based on these and many other findings, the MEA argues:

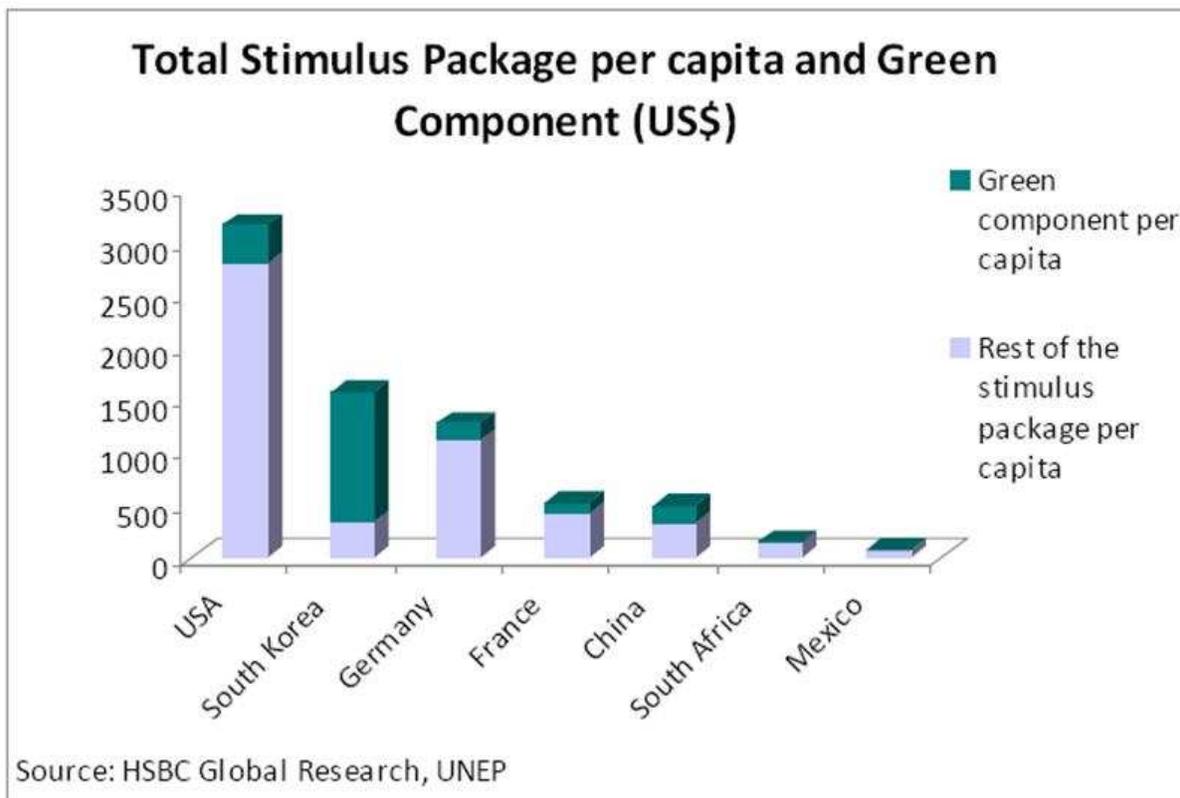
“The consumption of ecosystem services, which is unsustainable in many cases, will continue to grow as a consequence of a likely three- to six-fold increase in global GDP by 2050 even while global population growth is expected to slow and level off in mid-century. ... An effective set of responses to ensure the sustainable management of ecosystems requires substantial changes in institutions and governance, economic policies and incentives, social and behaviour factors, technology, and knowledge. ... Costs of unsustainable resource use are rising, but get displaced from one group to another (in particular the poor) and to future generations.” (United Nations 2005)

12 Appendix C: International Responses to the Economic Crisis

“The strategic choice to be made is to use a green recovery programme as a ladder into a new energy economy -- one based on lesser and lesser reliance on fossil-based fuels. This should be the core reason for arranging a stimulus package for green programmes, especially in the energy sector.” Saliem Fakir

12.1 International Summary

Recovery packages & green investment¹¹⁹:



12.2 Australia

- 20% of electricity to be from Renewables by 2020.
- Possibility of up to 1.7 million new jobs by 2020¹²⁰.

12.3 China

10% of its \$586 billion stimulus package for sustainable development. Renewable energy target of 15 percent of primary energy consumption by 2020. Could spend up to an additional USD440 billion to USD660

¹¹⁹ UNEP, *Global Green New Deal: An Update for the G20 Pittsburgh Summit*, 2.

¹²⁰ Global Climate Network, *Low-Carbon Jobs in an Inter-Connected World summary - discussion paper 3*, 3.

billion in its clean-energy build by 2020¹²¹. Wind, solar and hydro power targets could create an additional 6.79 million jobs¹²².

“The Chinese model is based on two reinforcing strategies: shift the national economy to a low carbon footing and use this shift to become a world player in low carbon technologies and goods.” Saliem Fakir

12.4 Germany

Germany: 10% of total recovery funds to energy efficient building retrofits¹²³.

Currently employ 278,000 workers in renewable energy, more than in conventional energy. By 2020, this. Could increase to between 353,500 and 400,000 by 2020¹²⁴.

12.5 India

- National Action Plan on Climate Change.
- Up to an additional 10.5 million jobs in wind, solar and biofuel¹²⁵.

12.6 Nigeria

- Renewable Energy Master Plan.
- Small-scale hydro power + gas power could create approximately 670,000 jobs¹²⁶.

12.7 South Korea

Committed to spend approximately two percent of its GNP (USD 84 billion by 2013), on environmental projects in a “Green New Deal” to spur economic growth and create a projected 1.5 million new jobs¹²⁷

12.8 United Kingdom

- Low Carbon Industrial Strategy
- Up to 70,000 UK jobs being created¹²⁸

12.9 USA

American Recovery and Reinvestment Act (ARRA) of 2009:

- \$787 billion total, \$100 billion earmarked for clean-tech related projects¹²⁹.
- Job creation potential of up to 1.9 million jobs¹³⁰.

USA Clean Tech Trends¹³¹

- Energy Efficiency

¹²¹ Pernick and Wilder, *Five Emerging US Public Finance Models*, 2-3.

¹²² Global Climate Network, *Low-Carbon Jobs in an Inter-Connected World summary - discussion paper 3*, 3.

¹²³ Pernick and Wilder, *Clean-Tech Job Trends 2009*, 10.

¹²⁴ Global Climate Network, *Low-Carbon Jobs in an Inter-Connected World summary - discussion paper 3*, 4.

¹²⁵ Ibid.

¹²⁶ Ibid.

¹²⁷ Pernick and Wilder, *Five Emerging US Public Finance Models*, 2.

¹²⁸ Global Climate Network, *Low-Carbon Jobs in an Inter-Connected World summary - discussion paper 3*, 4.

¹²⁹ Pernick and Wilder, *Five Emerging US Public Finance Models*, 2.

¹³⁰ Global Climate Network, *Low-Carbon Jobs in an Inter-Connected World summary - discussion paper 3*, 4.

¹³¹ Pernick and Wilder, *Clean-Tech Job Trends 2009*.

- Labour transformation towards clean tech – skills & training
- Clean manufacturing situated near end-use markets
- Information Technology growth in smart grid technologies

USA Top Future Industries¹³²:

- Solar PV Manufacturing
- Green Building Design Services
- Wind Power Development
- Sustainable Bioenergy
- Smart Grid Technologies

USA Green Job sectors¹³³:

- Energy
 - Renewable Energy
 - Energy Storage
 - Energy Conservation and Efficiency
 - Smart Grid Devices and Networks
 - Electric Transmission and Grid Infrastructure
 - Biomass and Sustainable Biofuels
- Water
 - Energy Efficient Desalination
 - UV Filtration
 - Reverse osmosis Filtration
 - Membranes
 - Automated Metering and Controls
 - Water Recovery and Capture
- Transportation
 - Hybrid-Electric Vehicles
 - All-Electric Vehicles
 - Electric Rail
 - Hydrogen Fuel Cells for Transport
 - Advanced Transport Infrastructure
 - Advanced Batteries for Vehicles
- Materials
 - Biomimicry
 - Bio-based materials
 - Reuse and Recycling
 - Green Building Materials

¹³² Pernick, Wilder, and Gauntlett, *Carbon Free Prosperity 2025*, 5.

¹³³ Pernick and Wilder, *Clean-Tech Job Trends 2009*, 3.

- Cradle-to-cradle systems
- Green Chemistry

USA Public financing models¹³⁴:

- Green Bank: “independent, government-sponsored enterprise to support, via loan guarantees, debt instruments and equity, the emergence of the U.S. clean-energy industry”
- Clean-energy victory bond e.g. world bank “green bonds”
- Tax Credit Bonds
 - Clean Renewable Energy Bonds (CREBs);
 - Qualified Energy Conservation Bonds (QECBs)
 - Build America Bonds (BABs).
- Federal Loan Guarantees
- City Funds
 - Homeowners borrow the funds necessary to pay for a solar array or an energy efficiency upgrade – then repay the loan (often at below-market rates) over a long-term period through their property tax or utility bill.

¹³⁴ Pernick and Wilder, *Five Emerging US Public Finance Models*.

13 Appendix D: Existing Policy & Commitments – National, Provincial & Local

Although policy in National, Provincial and Local government has not fully integrated the challenges outlined above, there is an emerging line of thinking that recognises the issues. This strategy for Gauteng is written within the parameters of existing national and provincial commitments, but turns them into concrete recommendations for realising commitments while pushing for green jobs and sustainable growth. The strategy seeks to turn commitments made at the G20, in various national and other documents, and provide concrete mechanisms and strategies for realising these in practice, all the while promoting both sustainable growth and job creation.

13.1 National Government

- White Paper on Energy Policy (1998)
 - Energy policy must facilitate optimal energy consumption and production to meet social needs.
 - Local & Provincial government have a limited role in energy governance. They are, however, responsible for economic and physical planning and, as such, are concerned with the supply and use of energy.
 - There is clearly a need for improved communication and co-ordination between national, provincial and local government. For instance, the implementation of energy policies should be better integrated with provincial and local economic and physical planning activities.
- White Paper of Renewable Energy policy (2003)
 - 10000 GWh (approx 4%) from Renewables by 2013
- National Environmental Management Air Quality Act (2004)
- National Water Resource Strategy (2004)
 - South Africa has allocated around 98% of the national water resource at a high assurance of supply
- Electrification targets (DME 2004)
 - Universal access by 2012
- Energy Efficiency Strategy (2005)
 - 12% reduction off the national electricity consumption forecast by 2015.
 - 9% reduction in final demand for transport
 - Reduction in final energy demand by sector:
 - Industrial: 15%
 - Commercial: 15%
 - Residential: 10%
- Electricity Regulation Act (2006)
- National Energy Bill (2008)
- National Framework for Sustainable Development (2008)

- National Integrated Waste Management Act (2009)
- Long Term Mitigation Strategy (2008)
 - 30% to 40% reduction in CO_{2e} emissions by 2050 off a 2003 baseline
- Framework for South Africa's Response to the International Economic Crisis (2009)
 - Section 3.6: "The parties recognise the opportunities in industries that combat the negative effects of climate change and believe that South Africa should develop strong capacity in these green technologies and industries. Accordingly it is agreed to develop incentives for investment in a programme to create large numbers of 'green jobs', namely employment in industries and facilities that are designed to mitigate the effects of climate change. Government will be asked to develop a proposal for consideration by the parties. This proposal will, where appropriate, build on current initiatives of greening existing manufacturing and service activities."
- Public investments programme
 - Approximately R787bn over the three financial years to March 2012
- Treasury
 - 2c/kWh levy on coal-based electricity – not allocated to any projects.
 - Adjustment of existing ad valorem excise duties on motor vehicles to take CO₂ emissions into account will be implemented on 1 March 2010.

13.2 Business

Business has also established a few initiatives that include:

- Voluntary Energy Efficiency Accord
 - In the accord businesses work together to try and achieve South Africa's Energy Efficiency targets.
- Carbon Disclosure Project
 - In the Carbon Disclosure Project, large corporate have been invited to conduct a carbon emissions audit of their businesses and make the information public.

13.3 Gauteng Province

13.3.1 Integrated Waste Management Policy (2006)

- Achieve integrated and environmentally sustainable waste management;
- Shift to a complete holistic approach including recycling and reuse.

13.3.2 Gauteng's Response to the Economic Crisis, Draft Strategy (2009)

- Creation of a renewable energy sector that enhances sustainable green job creation;
- Ensure the promotion and facilitation of investment in local renewable energy technology manufacturing facilities;
- Ensure increased investment in programmes and projects that will create large numbers of 'green' and decent jobs by both the province and municipalities;

- Focus on community orientated waste management and recycling programmes; and
- Establishment of green corps that assumes responsibility for management of environmental rehabilitation programmes.

“Gauteng will be a leading African City region that plays a key role in driving and supporting the boundless opportunity presented by African economic growth in the 21st Century. It will be the Southern hub of innovation, sustainable settlement, knowledge and culture on the continent and will be richly integrated with African cultural, economic and communication networks.” Pg 20

13.3.3 The Gauteng Employment Growth and Development Strategy 2009 – 2014 (2009 Draft)

- Vastly increase opportunities for the unemployed;
- Support labour-absorbing sectors;
- Create 150 000 sustainable, full-time employment opportunities directly by 2015.

13.3.4 Gauteng Integrated Energy Strategy (Nov 2009 Draft)

Energy vision: A Gauteng province that is powered by a low carbon economy with a significant share of national “green jobs”, and accessible and affordable energy services that do not impact on the health of people or the environment.

The Premier stated that “we in Gauteng are committed to:

- moving our province to a low-carbon economy;
- ensuring that our carbon emissions peak and start declining by 2030;
- ensuring that we will improve on our record of energy efficiency;
- ensuring that we scale up hugely our renewable energy options; and
- ensuring that we make energy access for the poor a priority.”¹³⁵

Furthermore, the purpose of the Gauteng Integrated Energy Strategy and Implementation Plan is to “direct the way that energy is supplied and used within the Gauteng province during the next 5 years (2014); 16 years (2025); 46 years (2055) and beyond, in an integrated and sustainable manner. This will be done by advancing and driving energy efficiency and supporting an energy supply mix that includes renewable energy technologies across the province. Within Gauteng, solar energy (solar water heaters) and energy from landfill gas are the most obvious short term renewable energy sources with the potential to buy renewable energy from wind and concentrated solar power from outside the provincial boundaries.”¹³⁶

2025 Targets:

- 15% improvement in energy efficiency across all sectors,
- 16% power from Renewables,
- 27% reduction in carbon emissions,

¹³⁵ Dept of Local Gov & Housing, *Gauteng Integrated Energy Strategy*, i.

¹³⁶ *Ibid.*, 1.

- 95% installation of energy efficient water heaters in middle-to-high income homes and 50% in low income homes.

13.3.5 Gauteng Province Air Quality Management Plan (Aug 2009)

- Proposes Provincial Ambient Air Quality Standards
- Proposes interventions in
 - Climate Change and Energy
 - To reduce the generation of greenhouse gases
 - Domestic Fuel Burning
 - To reduce the current air pollution concentrations to acceptable levels in domestic fuel burning areas
 - Industrial Emissions
 - To comply with both national emission limits and ambient air quality standards.
 - Mine Tailings Dams
 - To minimise dust deriving from these sources
 - Vehicle Tailpipe Emissions
 - To reduce vehicle tailpipe emissions
 - Noise Pollution
 - To reduce the noise levels to acceptable residential levels at all times.
 - Cooperative Governance and Information Management
 - To ensure that information is readily available to stakeholders through sufficient data collection, collation and dissemination

14 Appendix E: Funding Options

14.1 World Bank

The World Bank in conjunction with the US government has launched the Renewables and Efficiency Deployment Initiative (or Climate REDI). This programme includes three new clean energy technology programs and funding needed to launch a renewable energy program under the World Bank's Strategic Climate Fund:

- The Solar and LED Energy Access Program will accelerate deployment of affordable solar home systems and LED lanterns to those without access to electricity. This program will yield immediate economic and public health benefits by providing households with low-cost and quality-assured solar alternatives to expensive and polluting kerosene.
- The Super-efficient Equipment and Appliance Deployment Program will harness the market and convening power of MEF countries to improve efficiency for appliances traded throughout the world. A number of MEF countries have implemented, or are exploring, incentive programs for energy-efficient appliances. Coordinating incentives, standards and labelling systems can create unprecedented economies of scale for these appliances.
- The Clean Energy Information Platform will establish an online platform for MEF countries to exchange technical resources, policy experience and the infrastructure to coordinate various activities in deploying clean energy technologies, and share this information with the world.
- The Scaling-up Renewable Energy Program (S-REP), under the World Bank's Strategic Climate Fund, will provide policy support and technical assistance to low-income countries developing national renewable energy strategies and underwrite additional capital costs associated with renewable energy investments. Funding through Climate REDI will accelerate the launch of S-REP.

The combined budget for these programs is \$350 million over five years

14.2 Carbon Finance

Carbon finance is available to large projects that reduce carbon emissions. There are two options:

- CERs or Certified Emission Reductions through the UN sanctioned Kyoto protocol
- VERs or Voluntary Emission Reductions, of which there are a number of trading schemes

These options should be explored for each project approached.

15 Appendix E: Additional information on Local Food Production

15.1 Case Study: The Cuba Experience

The Cuban experience of localising the food system highlights many of the benefits of local food economies, as well as some of the limitations. Trade embargos from the USA coupled with the collapse of the Soviet Union in 1991 left the island nation of Cuba without a reliable supply of fossil fuels and imported food as well as agrochemicals and farm machinery, yields fell dramatically and the country experienced a food crisis for several years during what was referred to as the *Special Period in Peacetime* (Rosset, 2002:xvi). “Cuba was forced to turn inward, toward its own natural and human resources, and top both old and new ways to boost production of basic foods without relying on imports” (Rosset, 2002:xiv). Food security was declared a national priority (Nieto & Delgado, 2002:40; Levins, 2002:278). Other priorities relating to the agricultural sector and food production included economic solvency (focussing on economies aimed at social development and security rather than profit maximisation) and protection of health (Levins, 2002:278). The government invested heavily into local food production to combat food shortages premised on organic methods of production, including massive urban agriculture programmes (Duenas *et al.*, 2009:31). Major changes in the structure of Cuba’s food system as it localised include the “diversification of channels of food distribution, and the greater variety of income sources for the population” (Nieto & Delgado, 2002:48).

“The ecological transformation of Cuban agriculture since the early 1990s is overwhelmingly complex, including changes in agrotechnology, land tenure and use, social organisation of production and research, education programmes and financial structures” (Levins, 2002:279). Food security has been promoted through self provisioning programmes (in home gardens, backyards or cooperatives) as well as the availability of basic food produce at cost (Nieto & Delgado, 2002:48). More vulnerable groups (such as children, pregnant women and the elderly) are monitored and assisted with special programmes (Nieto & Delgado, 2002:49) and food directed to those most in need (e.g., when milk was in short supply, it was prioritised for children first), (Levins, 2002:278).

Urban agriculture in Cuba has been a major part of the agricultural movement with a strong focus on the productive use of space for food security. The core principles of urban agriculture in Cuba, as identified by Companioni *et al.* (2002:220), include “organic methods, which do not contaminate the environment; the rational use of local resources; and the direct marketing of produce to consumers”. The government invested heavily into urban agriculture whereby “an extensive network was built up for the provision of training courses and extension services, and the distribution of seeds and tools” (Duenas *et al.*, 2009:31). The production methods varied from raised beds and balcony gardens to intensely concentrated hydroponic farms and other specialised systems, in total creating over 160 000 jobs for people from a variety of backgrounds (Companioni *et al.*, 2002:221). An estimated 90 percent of fresh produce consumed in Havana was being produced in and around the city by 2002 (Companioni *et al.*, 2002:235). Today there are an estimated 350 000 ‘urban farmers’ growing crops on over 700 000 hectares, with production from

cities increasing from 4000 tonnes per annum in 1994 to over 400 000 tonnes in the first three months of 2009 (Duenas *et al.*, 2009:31).

Through concentrating on low external input production in the absence of cheap oil, Cuba has created “highly efficient organic systems” (Duenas *et al.*, 2009:31), ensured food security and created jobs - showing to the world the possibility of producing sufficient food in a low carbon future. **Figure 29** below highlights how today Cuba is the only country in the world that is living within the world’s biocapacity and simultaneously promotes a high quality of life¹³⁷, inferring that it is the only country that has been able to achieve environmentally sustainable human development. “What if economic development is not a goal in itself but a means to enriching life and preserving nature, with emphasis on equity, health, education, culture, recreation, and mutual caring in an environment which is sustainable, diverse and people friendly? That is the unique path that Cuba has embarked on” (Levins, 2002:276).

¹³⁷ “Countries’ progress towards sustainable development can be assessed using the United Nations Development Programme’s (UNDP) Human Development Index (HDI) as an indicator of well-being, and the footprint as a measure of demand on the biosphere. The HDI is calculated from life expectancy, literacy and education, and per capita GDP. UNDP considers an HDI value of more than 0.8 to be “high human development”. Meanwhile, a footprint lower than 1.8 global hectares per person, the average biocapacity available per person on the planet, could denote sustainability at the global level” (WWF, 2006:19).

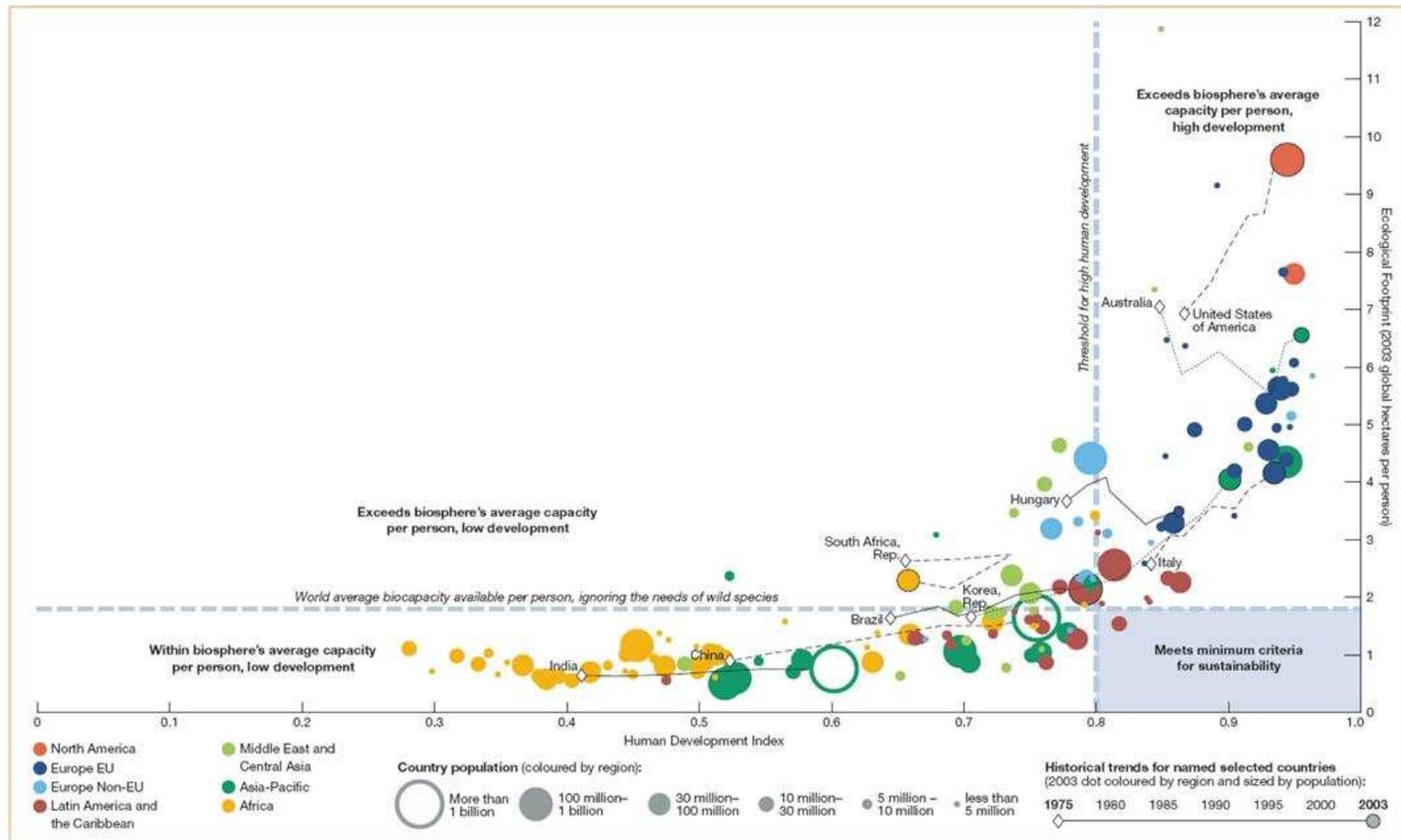


Figure 29: Human Development Index and Ecological Footprint

Source: WWF, 2006

15.2 Environmental Benefits of Food System Regionalisation

A key aspect of local food economies, beyond building community resilience through strengthening the local economy and social networks, is the potential for promoting increased environmental sustainability through the localisation of the food system. The most published finding is the potential for reduction in embodied energy associated with the localisation of food production and distribution. Reducing the distance that food travels unnecessarily offers important savings in the total contribution of the food system to greenhouse gas emissions. The food miles argument presents one aspect of the total energy embodied in production but, as has been described, investigation into both what is being produced and methods of production are almost of more importance. Embodied energy can further be reduced by other characteristics associated with local food economies including reduced refrigeration (produce is typically picked on the day of sale) and packaging (as consumers receive produce more directly from the farmers and do not require excessive packaging).

It appears that the greatest reductions in contributions to climate change, as well as other environmental challenges, stand to be made from changes of on-farm practices. Research by Pretty (2001:07) suggests that the greatest externalities of the modern food system lie in on-farm practices (i.e., the impact on the environment is greater on-farm than as a result of international transport). In this context, the links between local and the tendency towards agroecological production and ethical consumption become increasingly important.

Local food economies rest on producers being able to grow a diversity of fresh produce for local consumption which typically takes place on smaller and more concentrated farms¹³⁸. Agroecologically grown produce requires stronger supporting agricultural knowledge systems but less external inputs, which in the context of peak oil, is a key feature of local food economies. Furthermore, “organic farming fits directly into local food systems. Consumers are looking for fresh, high quality, good tasting produce” (Francis *et al.*, 2008:92). Consumers who actively support local food economies are typically also supportive of agroecological and environmentally sound methods of production. Experiences with local food movements have shown that as consumers become increasingly connected with their food system and the associated impacts thereof, they actively seek healthier and environmentally friendlier food as well (Hinrichs, 2003:36). Agroecological methods of production reduce dependency of farmers on increasingly expensive external inputs and improve the long term sustainability of their farming enterprise by building the integrity of the supporting natural environment (Pretty, 2001:07; Peters *et al.*, 2008:02). In this way, local and organic is to the benefit of the small-scale farmer as well. A characteristic of local food economies is the support of a wider diversity of crops contributing to investment in the integrity of supporting ecosystems critical for building strong local foodsheds. The environmental benefits of agroecological approaches often linked to local food systems are numerous, and include the protection of watersheds, encouraging biodiversity and enhancing wildlife habitats (Francis *et al.*, 2008:92).

¹³⁸ “Small-scale, ‘local’ farmers are not inherently better environmental stewards, although having fewer acres or stock to care for may make this more likely” (Hinrichs, 2003:35).

Furthermore, local food economies are associated with a reduction in waste through the reduction of packaging. The understanding between producer and consumer allows the producer to sell produce that does not conform to typical retail standards and thereby reduce food waste of products that would otherwise not be considered fit for retail sale. For example, farmers wanting to sell zucchinis to pack sheds to be sent to distribution warehouses to be sold at supermarkets need to ensure that the zucchinis are within a very limited length range so that they can fit in the standard styrofoam packaging. These standards can often be prohibitive for small-scale farmers who grow with agroecological methods (Reardon *et al*, 2002 in Pimbert, 2008:20).

Local food economies further encourage the recycling of nutrients within the local system. Kitchen waste becomes a nutrient input for backyard and urban food gardens whilst smaller farms associated with local food systems are better suited to the recycling of nutrients on farm through the diversified range of activities they are engaged in and by adopting a closed loop or systems approach to the entire local food economy (Norberg-Hodge, Merrifield & Gorelick, 2002:33). This overcomes some of the major environmental challenges associated with the modern food system, such as the waste produced by concentrated animal farm operations or the need for bringing in high external inputs to replenish nutrients (Halweil, 2004:39).

15.3 Social Benefits of Food System Regionalisation

Fresh organic vegetables are estimated to be on average ten times more nutritious than vegetables purchased from conventional supermarkets (Norberg-Hodge, 2009:03). Local food systems are also considered to decrease food safety risks through the decentralisation of food production (Gussow, 1999 in Peters *et al.*, 2008:03).

Local producers are associated with primary production of a diverse range of fresh produce ranging from vegetables, fruit, nuts and cereals to meat, milk and eggs which has implications for increasing access to nutritional fresh produce for local consumers' part of the local food economy. Furthermore, local food systems tend to promote the eating of seasonal produce that are adapted to local climates.

Local food economies have important roles to play in building community connections as well. "Not only does an adequate, varied diet contribute to individual health, but the way food is grown, distributed and eaten also profoundly affects the environmental, social, spiritual and economic well-being of the community" (Feenstra, 1997:28).

An important and often difficult to measure benefit from local food economies is the value of reconnecting with the natural environment and local community through local food initiatives (Pinkerton & Hopkins, 2009:29). Nature deficit disorder (commonly referred to in children who are increasingly disconnected from the natural world) results not only in poor physical conditions but impacts on mental and spiritual wellbeing as well, and is an increasing concern for both urban and rural residents alike (Louv, 2007). Children

connected to their food systems and natural environments arguably have stronger self-esteem and healthier identities (Norberg-Hodge, 2009b:05).

15.4 Building Knowledge Networks

Achieving food sovereignty and long term sustainability, which safeguards the livelihoods of the millions of families relying on agriculture, will require us to transcend modern understanding and approaches to agriculture. This will only be achieved if we embrace a more transdisciplinary approach which recognises both the complexity and multiplicity of food systems (IAASTD, 2008). This will rest on valuing agricultural knowledge systems and technology, and require us to become wiser and more creative in our solutions to the many challenges presented with navigating a new path towards achieving real development which is indeed sustainable. A key recommendation in preparing Gauteng for a more sustainable future with a gentle transition into a low energy future is through building knowledge systems that promote learning for change (Pretty, 2002). Feenstra (1997:34) identifies leadership, collaboration and civic renewal as crucial in building stronger local food economies linked to equitable and sustainable communities. Learning through experience has been highlighted as one of the most meaningful methods of shifting behaviour and again points to the importance of connections with local food systems that allow opportunities for such engagement. In this way, local food economies are as much about the flow of knowledge and social capital as resources, as about the flow of food itself.

16 Appendix F: Water Demand Management Project

The Water Demand Management Programme, hosted by the DBSA, and supported by the Swedish International Development Cooperation Agency (Sida), is a Southern Africa Development Community (SADC) region Programme. The development objective of the Programme is “to entrench a Water Demand Management (WDM) culture in Southern Africa that contributes to the SADC goals of regional integration and poverty alleviation through pro-poor, efficient and sustainable utilisation of water in the SADC region.”

The Programme intends to build on the two previous phases of a Sida financed WDM project, implemented between 1997 and 2004. The principle objectives of the Programme include: garnering greater acceptance and consolidation of pro-poor WDM practices in Southern Africa; implementing WDM activities and creating confidence among credit institutions to finance WDM projects.

All activities the Programme will undertake can be categorised into one, or a combination of three different types of services: namely, support services, project development service and finance facilitation services. Support services will assist in promoting a favourable environment in which WDM actions can take place. Project development services are largely grant-based. It is one of the objectives of the WDM Programme that services move from being grant-based to loan based.

It is envisaged that the support services will create a well informed demand. The project development and finance facilitation services will be offered in response to a demand for actual implementation of WDM practices. In order to find out more about how to request assistance with implementation on WDM activities through the Demand-Response system, please contact the Project Implementation Unit (PIU) directly.

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