Department of Environmental Affairs and Development Planning

Sustainable Energy Strategy and Programme of Action for the Western Cape

November 2007

Structure of this Energy Strategy Document

This document, which presents the *Sustainable Energy Strategy and Programme of Action,* is structured around the mechanisms and mandates that allow for the Western Cape Provincial Government to influence the manner in which energy is supplied and used in the Western Cape.

The document is presented as follows:

Chapter 1 provides an introduction to the energy vision for the Province,

Chapter 2 deals with the motivation and mandate for the Province to pursue an energy strategy

Chapter 3 provides and overview of the Energy Picture of the Western Cape

Chapter 4 outlines the Demand Side Energy Scenarios and opportunities for efficiency interventions

Chapter 5 describes the energy supply picture and options for the Western Cape

Chapter 6 describes the energy planning approach taken in the strategy

Chapter 7 outlines the Renewable Energy options and Programme of Action

Chapter 8 identifies how the programmes and actions should be delivered to implement the energy strategy, as well as describes the approach taken and the partnerships that should be developed

Chapter 9 provides an easy to follow Strategy outline and Programme of action

This document is part of a suite of documents which include:

1. This ***Sustainable Energy Strategy and Programme of Action*;**
2. ***The Sustainable Energy Strategy and Programme of Action Compendium;***
3. ***The Renewable Energy Strategy and Action Plan (Scenarios, Options and Resource assessment); incorporating The Demand Side and Energy Efficiency Strategy and Plan of Action; and,***
4. ***Consolidated Comments – Stakeholder Consultation Process.***

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FOREWORD

The power outages experienced in the Western Cape during 2005 and 2006 have highlighted the importance of sustainable energy supplies to the successful socio-economic development of the region. With the aim of ensuring that the crucial issues of energy and economic development, climate change, human capital development and regional investment priorities are effectively addressed, the Department of Environmental Affairs and Development Planning is launching this *Sustainable Energy Strategy and Programme of Action for the Western Cape*.

The initiative forms a vital cornerstone in sustainable development policy for the Western Cape. As has recently been so clearly demonstrated, energy security plays a crucial role in ensuring that the Province can meet its economic, social and environmental objectives, and that it remains an attractive destination for investment.

A sound energy strategy and programme is essential in addressing environmental concerns, including climate change. The need to secure sources of cleaner, non-polluting and renewable energy as part of our future development plans has become an important consideration and this strategy addresses the challenges of developing a clean energy industry in the Province. This strategy and programme is being developed and refined in partnership with key stakeholders in the Province and will continue to evolve to ensure energy security and sustainable development. Working within the parameters set by national government, and taking into account the various initiatives at local government level across the Province, the Sustainable Energy Strategy and Programme seeks to:

- support economic and social development, poverty alleviation and infrastructure development;
- address environmental issues such as air quality, energy conservation and climate change;
- foster the development of a clean energy sector; and
- support and enhance provincial investment programmes in an effective manner.

The *Sustainable Energy Strategy and Programme of Action* has been developed to support and complement our commitments contained in the Provincial Growth and Development Strategy and the Sustainable Development Implementation Plan, as well as contributing to the achievement of the Millennium Development Goals and the Johannesburg Plan of Implementation. This will all be supported through a future institutional structure. Thus our approach towards embedding sustainable development – social equity, economic development and ecological integrity – as a fundamental aspect of *Ikapa Elihlumayo* is proactive and bold.

We invite all of you as stakeholders to partner with the Department in further developing and refining this Sustainable Energy Strategy and Programme of Action so that we can continue to live up to our commitment to ensuring the Western Cape is a “Sustainable Home for All, Forever”.

INTRODUCTION

Due to the recent energy crisis in the Western Cape, the process of introducing a sustainable energy strategy and plan of action has been fast-tracked. It is believed that this is necessary to ensure that measures to reduce energy consumption and increase the supply of clean, renewable energy can be taken as soon as possible.

This document outlines the key energy concerns and opportunities facing the Western Cape. It proposes a range of policies, strategies and actions that will allow the Province to develop a sustainable portfolio of energy solutions while also reducing pollution and increasing access to energy for all citizens in the Province.

The Western Cape Sustainable Energy Strategy and Programme of Action is one of a suit of documents and strategies developed by the Department in order to contribute towards the development of the optimum sustainable energy profile for the Western Cape. Other documents/strategies are

- Demand Side Scenarios and Energy Efficiency Programme for the Western Cape,
- A proposed Renewable Energy Plan of Action for the Western Cape.
  (Resource Assessment, Scenarios, Proposed Objectives and Actions).

The above documents are available on the Department's website www.westerncape.gov.za/eadp

Energy concerns are cross-sectoral and must be handled in an integrated manner. It is therefore essential for the full range of stakeholders to take ownership of the strategy from all levels of government and all sectors, including transport, housing, health, social development, and economic development. It is also crucial for the Province's energy strategy to be integrated into existing and pending policies and strategies for the Province's development, such as the Strategic Infrastructure Plan, the Micro-Economic Development Strategy (MED's), the Spatial Development Framework (SDF) and the Local Economic Development Strategies (LED's).

The Department of Environmental Affairs and Development Planning (D:EA&DP) consulted with stakeholders in government, as well as business and civil society to comment on the proposed approach and strategies in 2006 and early 2007. The discussions with key stakeholders, as well as all comments received on draft documents were taken into account in developing the Province's Sustainable Energy Strategy and Programme of Action.

1 THE PROVINCIAL SUSTAINABLE ENERGY STRATEGY, VISION & INTENT

The energy vision for the Western Cape takes its impetus from the goals of *Ikapa Elihlumayo, the Provincial Growth and Development Strategy* and the *Sustainable Development Implementation Plan*. The Provincial strategic energy vision is:

Sustainable Energy Vision for the Western Cape

The Provincial Government's Sustainable Energy Strategy seeks to ensure that the Western Cape has a secure supply of quality, reliable, clean, safe energy, which delivers social, economic and environmental benefits to the Province's citizens, while also addressing the climate change challenges facing the region and eradicating energy poverty.

This 2020 vision for the Western Cape aims to demonstrate how the potential for technological, institutional, economic and social change could come together to create a sustainable energy system, determined energy demand management and support for a mix of renewable and clean energy technologies.

The technologies and options for delivering on this vision largely exist, and with support from the Provincial Government could be brought about in a more focused and rapid fashion. It is thus the Provincial Government's key objective to create an environment within which these technologies and initiatives may flourish in support of achieving the energy vision.

Achieving a sustainable energy system across the Province will require changes in energy sources as well as a fundamental change in the way the system operates. By changing the demand profile and behaviour across the Province it is envisaged that the delivery of energy services will also change. The Provincial Government will assist in removing a number of the barriers associated with the adoption and commercialisation of clean energy technologies and initiatives. These are described more fully in the programme of action.

This strategy sets out how the Western Cape will develop a cutting edge sustainable energy programme and begin moving toward the long term vision. The Provincial strategic intent is:

Sustainable Energy Strategic Intent for the Western Cape

To develop a sustainable energy system that reduces its impact on people's health and the environment whilst contributing to long-term sustainable economic development.

In the medium- to long-term, the strategy objective is to lessen the Province's dependence on energy generated from fossil fuels and polluting sources, and to generate energy closer to the points of use in order to reduce efficiency losses through transmission.

A look into the Future: The Energy picture in the Western Cape in 2020

In 2020 the Western Cape has a modern energy system that is highly efficient and where fossil fuel use and fuel poverty are markedly reduced. Energy efficiency programmes achieve a 15% savings across the various programmes, clean and renewable energy contributes to 15% of the energy mix and emissions reductions of 15% are achieved (relative to 2006 figures). Provincial and local authorities have an understanding of the impacts of their energy use patterns and play a leading role in implementing the energy strategy across the Province.

Sustainable Energy Use

Innovation in energy generation and production across all sectors leads to a more efficient use of modern energy sources and which is characterised by:

- a high performance building stock (both public and private sector) brought about by designing new buildings and retrofitting old buildings according to green design principles
- widespread implementation of demand side energy management programmes and technologies in businesses, homes, government and commercial buildings
- greater use of energy efficient appliances are adopted across all sectors
- a modal shift toward lesser polluting transport technologies, fuels and vehicles
- energy services companies that provide effective energy services to the various communities across the province based on the specific needs in the various areas
- solar water heaters, solar photo-voltaic and other demand reducing technologies are implemented across various sectors and across a wide spectrum of communities
- a reduction in fuel poverty, pollution and respiratory illnesses, and safety threats through the use of cleaner, safer domestic fuels

Sustainable Energy Provision

A generation system that recognises a greater portion of energy from renewable sources (15% by 2014) and a high fuel productivity and which is characterised by:

- extensive renewable energy generation across the Province by Independent Power Producers from sources such as wind, wave, biomass, solar, small hydro
- a focus on developing decentralised energy generation systems and micro-generation
- combined heat and power systems operating in a greater number of businesses, homes and industries
- fuel cells and clean propulsion systems dominant in transport, heat and power and which complement renewable energy production
- natural gas and cleaner fuel sources which are to replace coal in the development of power generation projects

Policy and Governance

The market, governance and institutional structures in the Province have developed to include:

- effective leadership and co-ordination of the sustainable energy policy and programme across the province
- fiscal reform initiatives, aligned with the national Treasury Environmental Fiscal Reform process, examining new means of financing clean energy initiatives and removing market barriers
- a series of new policy and practice guidelines, at local government and Provincial government level prioritising energy productivity in buildings (residential, commercial), vehicles and industrial settings
- effective partnerships development, education and communication strategy implementation with all key role players in the provincial energy system ensuring the Programme of Action is implemented and the targets achieved.

The development of the Sustainable Development Implementation Plan and the focus on creating a sustainable energy future will create a competitive advantage for the Western Cape, contributing to the achievement of the goals of Ikapa Elihlumayo and the economic growth imperatives.

2 MOTIVATION AND MANDATE FOR A SUSTAINABLE ENERGY STRATEGY

The recent energy crisis in the Western Cape has highlighted the need to develop a plan for sustainable, secure energy provision in the Western Cape. Although various national efforts are underway to increase energy provision to the Western Cape, the Provincial Government believes that additional efforts need to be made to address the energy challenges facing the Province through determined energy demand management and support for a mix of renewable and clean energy technologies, including the challenges of:

- providing access to energy to all citizens in the province, and
- addressing the numerous health, social and environmental problems associated with our current energy use patterns, and
- reducing the Province's carbon footprint,

These challenges need to be addressed in the context of supporting the Province's economic development and job creation.

Energy and Poverty in the Province

Poverty eradication and development remain two key objectives for the Provincial Government. The links between energy poverty and under-development have been clearly established and dealt with extensively in the Status Quo Report. In many instances it is the poor communities living in un-electrified dwellings in informal settlements or those living in rural and peri-urban areas who experience this most severely. Many of the informal settlements are regularly the scenes of large scale fires caused by the use of paraffin stoves in unsafe conditions. Challenges to gain access to modern and affordable energy services exist in the Province and need to be addressed.

Energy efficiency and water use in the Province

Energy use and water use are linked in various ways:
For every kWh of electricity generated, 1, 26 litres of water is used – mainly in coal-fired power stations.

- Water pumping requires energy. Typically, around 1.8kWh may be required to supply 1 kl of water to households (and thus account for around 1.6 kg of CO_2[1]).
- A typical mid to high income house can save 20% of water consumption with ease. Since urban water consumption profiles are often dominated by domestic use, water efficiency interventions in households will result in substantial energy savings on a city and provincial scale.
- Through efficient showerhead installation, hot water consumption for showers will be reduced by around 40%. This translates to significant energy savings, since the major consumer of electricity in many households is for heating water.

The above illustrates the interdependence of water and energy efficiency, and reinforces the need for inter-departmental co-ordination and support in moving towards a more sustainable situation.

[1] Alliance to Save Energy: 'Financial Models for Urban Water Supply Interventions'

Energy and transport in the Province

Transport is one of the fastest-growing sectors of energy use, with road transport being the major sub-sector. As an example, transport accounts for 54% of total Cape Town energy consumption[2] yet the focus on transport is addressing equity issues at a macro level without a similar emphasis on energy efficiency. The Provincial Energy Scenarios (Borchers etc al, 2006) found that the bulk of energy use across the Province can be attributed to electricity consumption and that transport is the second largest energy consumer. The importance of an affordable clean energy public transport system cannot be overemphasized in addressing socio-economic sustainability issues.

Energy Efficiency and Renewable Energy

Energy efficiency offers opportunities for cost savings for businesses and households whilst certain renewable energy applications are on the verge of proving their commercial viability in the South African context. As the demand for clean and renewable energy increases, a range of business and employment opportunities will be created leading to the development of a vibrant clean energy sector.

Climate Change and Energy – a Provincial Picture

This strategy also focuses on climate change and the potential impacts that this may have on the agricultural and tourism sectors. Community members employed as seasonal workers on farms, as well as the farming communities themselves, are already bearing the brunt of unusual events such as the massive fires that raged across dry areas of the Province. Added to this, continued water shortages and the potential that the Province may become drier as time goes on, pose additional challenges.

The Province's Carbon Dioxide Emissions Profile

Most of the carbon dioxide released from energy use within the Province comes from electricity production, followed by petrol and diesel use. Industry is the largest user of electricity in the Province, followed by the residential sector, commerce and government. The carbon footprint represented by the tons of CO_2 emitted per annum in the production of electricity mirrors the electricity use in each sector. The global warming emissions of the Province (represented as CO_2 equivalent) originate mainly from electricity use (52% of the total) due to the high CO_2 intensity of South Africa's principal generation source which is coal. On a sectoral basis, industry is responsible for most of the CO_2 emissions.

Sector	thousand ton CO_2/year	% of total
Industry	15,956	47.3%
Mining and Quarrying	751	2.2%
Transport	7,529	22.3%
Agriculture	2,045	6.1%
Residential	5,224	15.5%
Commerce & Public Services	2,259	6.7%
Total	**33,764**	**100%**

Figure 1: Carbon footprint for Western Cape Electricity use by sector

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Fuel	thousand ton CO_2/year	% of total
Electricity	18,311	54.2%
Petrol	4,711	14,1%
Paraffin & jet fuel	145	0.4%
Diesel	3,643	10.8%
Fuel oil	642	1.9%
LPG	375	1.1%
Coal	4,513	13.4%
Other	1.366	4.0%
Total	**33,764**	**100%**

Figure 2: Carbon footprint for Western Cape energy use by fuel

The carbon dioxide emissions profile provides clear areas for intervention in the development of the Provincial Sustainable Energy Strategy. Although South Africa does not face an emissions reduction target, it is clear from these figures, as well as from the climate change review conducted by the Provincial Government, that mitigation and adaptation strategies are necessary to deal with the predicted future consequences of climate change. The Department developed a Climate Change Response Strategy and Action Plan in response to the need to combat climate change and this forms part of the immediate term action programmes in this document.

The Provincial Climate Change study highlights the nature and potential severity of the impacts of climate change on the Province.

The Provincial Sustainable Energy Mandate

It is not proposed that the Provincial Government should act as a reticulating or generating authority of energy, but rather that it should act in a capacity which stimulates the economy, combats climate change, improves public transport, promotes sustainable practices and supports local government. In this context, promoting renewable energy and energy efficiency is well within the Provincial Government of the Western Cape's (PGWC) mandate.

Energy concerns impact on a full range of sectors and activities and this issue is a prime example of an area requiring co-operation between the different spheres of government. The PGWC is actively seeking to co-operate with other government bodies around energy concerns, and proposes to provide assistance, support, and leadership. Through a process of internal discussion as well as public participation, the Provincial Government is attempting to ensure that its efforts to develop the renewable energy sector and promote energy efficiency are co-ordinated with the efforts of other spheres of government relating to energy.

The Provincial Government can also play a leadership role in this area, by ensuring that its internal functioning promotes energy efficiency, and that it supports research, development and implementation of cleaner energy production, distribution and consumption.

The kind of role that the PGWC wishes to adopt in relation to energy is consistent with the roles adopted by provincial governments across the world, and the PGWC is taking some direction in this matter from the governments with which it has twinning arrangements.

Provincial Government Mandate

The Provincial Government's mandate to develop a Sustainable Energy Strategy & Programme of Action stems from its clear mandate around economic development, housing, provision of public transport and environmental protection. The use of energy impacts other natural resources, such as water, and Province must take a more sustainable approach to resource consumption in general, with energy being one of them.

3 ENERGY PROFILE OF THE WESTERN CAPE

Energy Consumption

In 2004, approximately 250 million GJ of energy was consumed in the Western Cape. By 2020, if the economy continues to grow as expected, it is predicted that the demand will grow to 375 million GJ, unless energy consumption patterns change drastically.

As shown in Figure 3, the industrial and transport sectors are currently the largest energy consumers. Combined, these two sectors account for 80 % of the total energy used in the province.

The transport sector is heavily dependent on petrol, while the industrial sector is the largest electricity consumer, and the second largest petrol consumer.

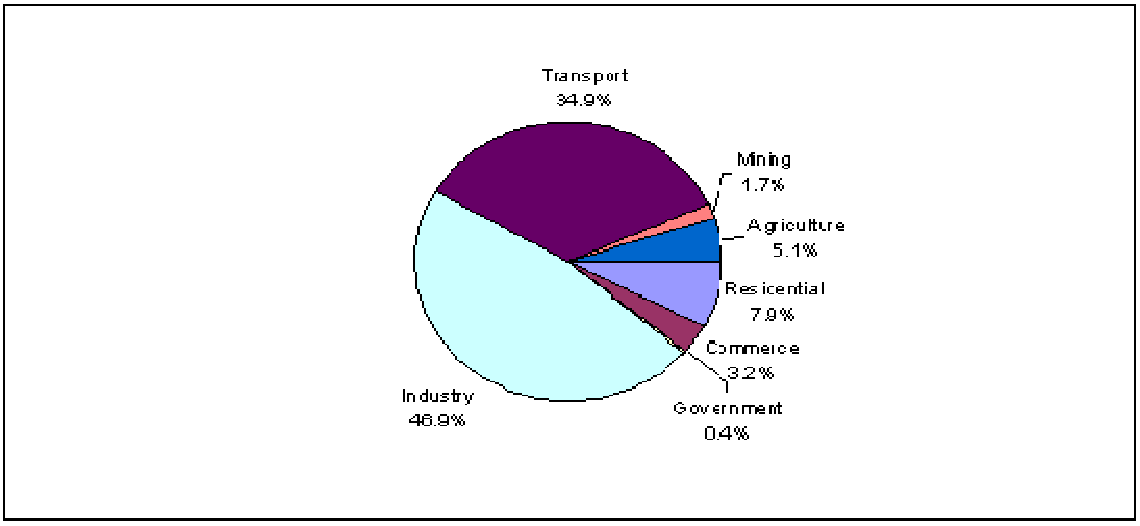

Figure 3: Western Cape Energy Consumption by Sector

Currently the Western Cape uses a range of fuels (Figure 4) to fulfil the energy requirements of its people and industry. The greatest final energy demand is for liquid fuels due mainly to their use in the transport sector, but also in industry, commerce, agriculture, mining and the residential sector. The next major final energy carrier is electricity followed by coal and relatively small amounts of wood.

The liquid fuel mix is dominated by petrol (mainly used in the transport sector) followed by large quantities of diesel (which is used in sectors other than transport as well) with far smaller quantities of fuel oil, Liquified Petroleum Gas (LPG) and kerosene (paraffin).

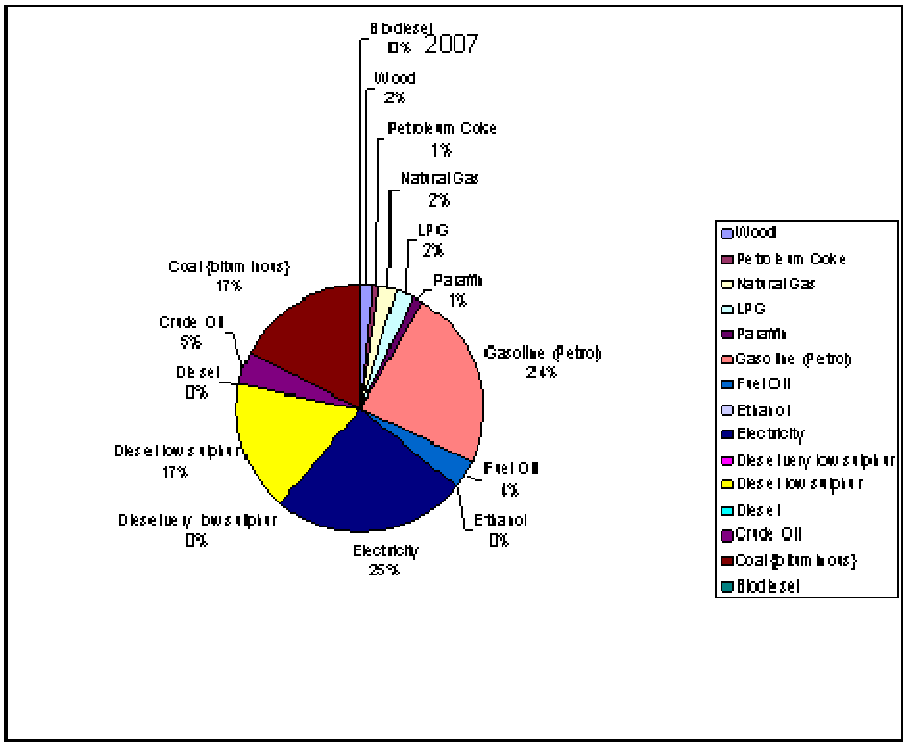

Figure 4: Total Energy Consumption in 2007

The Provincial share of total national energy demand is 10% at 247,752 TJ. If the province were to achieve its GGP hi-growth scenario of 6%, energy consumption will look like:

Table 1: Energy use implications of a higher (6%) GGP growth rate

(million GJ)	**2004**	**2005**	**2006**	**2010**	**2014**	**2015**	**2020**
Total for 2.8% growth	247.751	253.459	259.337	287.512	319.349	327.947	375.248
Total for 6% growth	247.751	253.892	260.24	290.731	325.737	335.287	388.552
% increase in energy consumption	0.0%	0.2%	0.3%	1.1%	2.0%	2.2%	3.5%

Industry (47% of total consumption)

This sector is the largest consumer of electricity and the second largest consumer of other fuels after transport. This is due largely to the petrochemical refineries: Caltex and PetroSA, the Iron and Steel industry, and other sub-sectors using high temperature thermal operations. This sector also includes the chemical industry, non ferrous metals, non metallic minerals, wood and wood products, food and tobacco and 'other industry' which includes textiles, construction and any other categories not covered by the preceding sub-sectors. Audits of various industries

around the country indicate that efficiency opportunities in industry are significant, many of which would cost nothing or have very short payback periods.

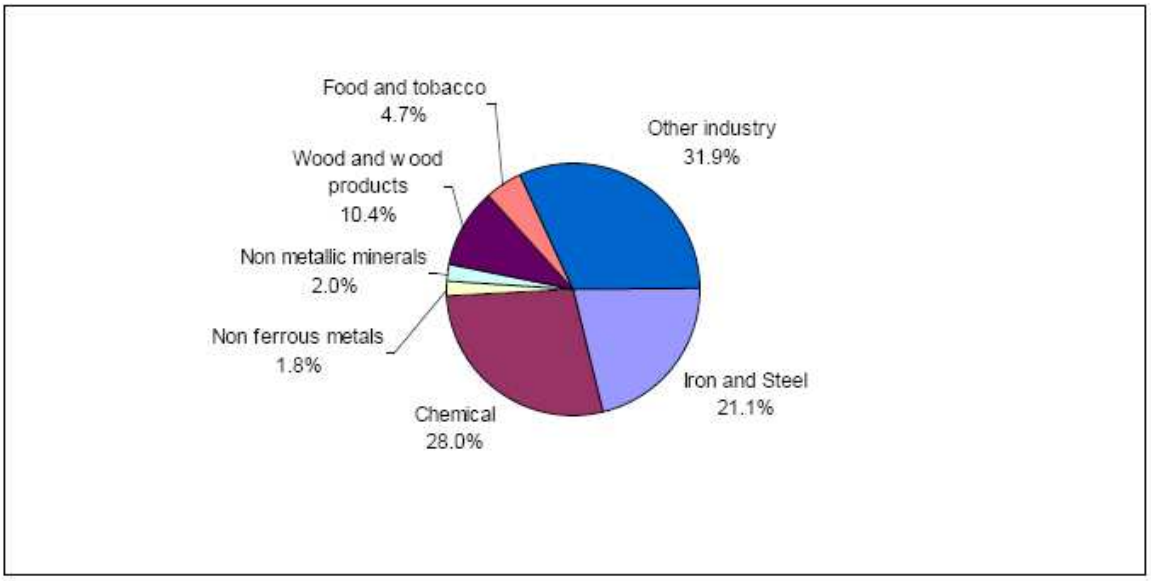

Figure 5: Energy use by sub-sector for the Western Cape industrial sector 2004

Figure 5 shows that the 'other industry', the chemical industry and the Iron and Steel industry dominate the energy demand in this sector.

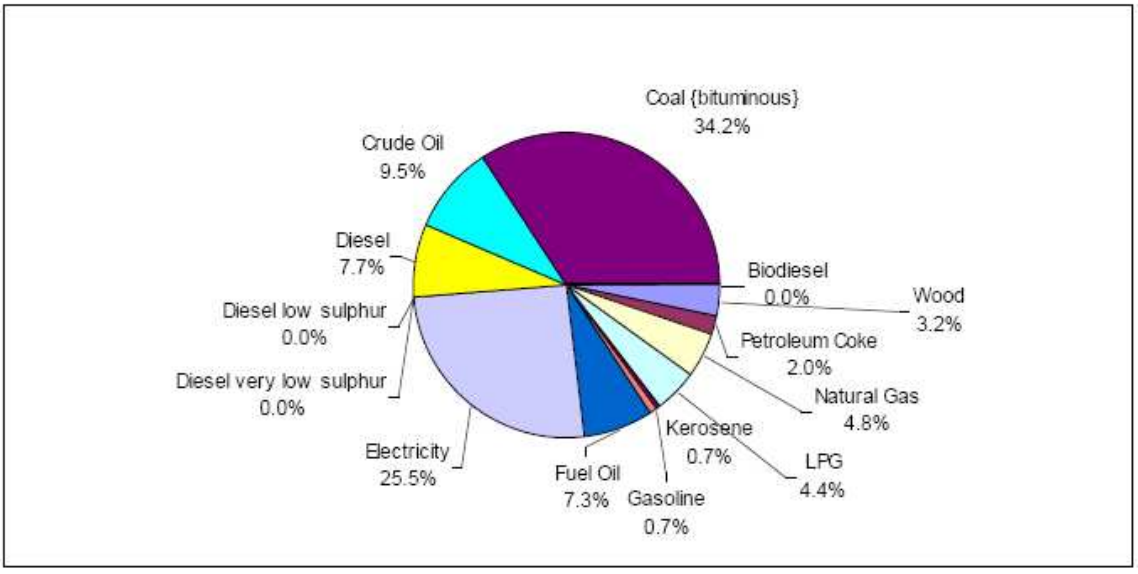

Figure 6: Energy use by fuel for the Western Cape industrial sector 2004

Coal and electricity are the dominant fuels used in industry, with crude oil, diesel and fuel oil making up a significant part of the remaining share.

Transport (35% of total consumption)

The majority of the liquid fuels consumed in the Western Cape are used in the transport sector.

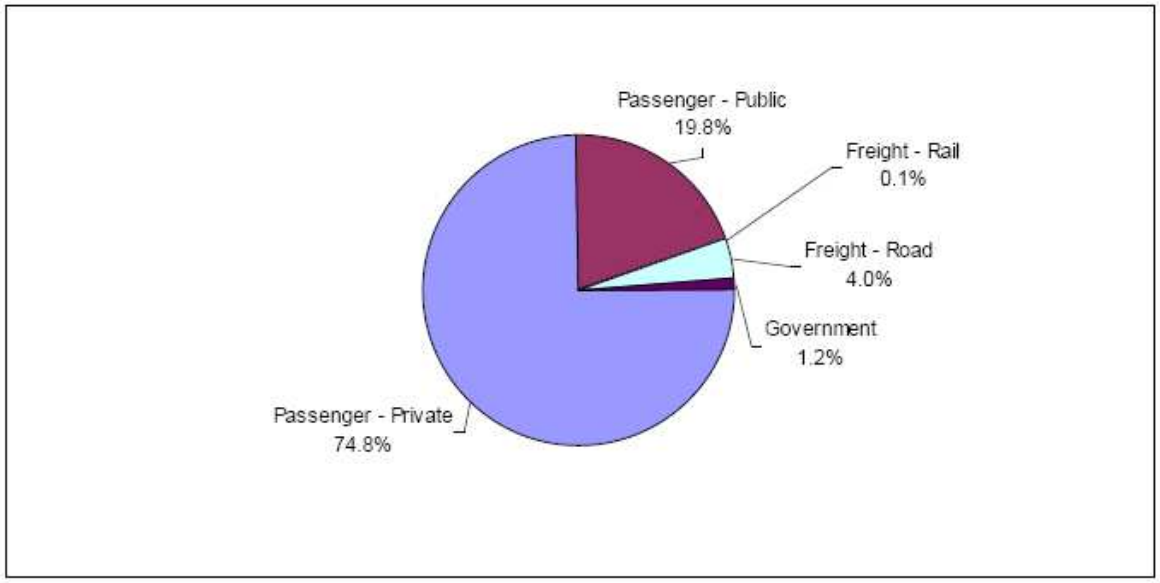

Figure 7: Energy use by transport sub-sector for the Western Cape 2004

The transport sector energy demand is largely dominated by private passenger use, with most of the remaining energy demand being made up by the public passenger transport sector. This results in the inefficient use of fuel and increased levels of pollution. In the public sector rail has been in a state of decay while minibus taxis have been growing, although rail still remains the backbone for public transport within the Western Cape. The transport sector is responsible for a large portion of the air pollution in the province.

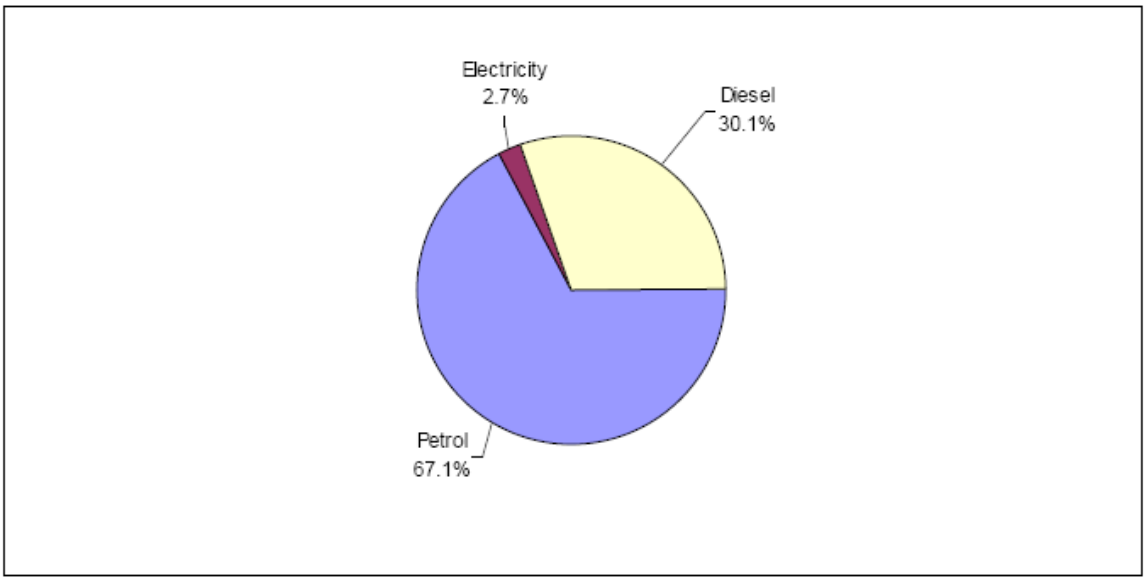

Figure 8: Energy use by fuel for the Western Cape transport sector 2004

It can be seen from figure 9 that petrol is the major fuel used in the transport sector with diesel making up most of the remaining share. Electricity, for trains, contributes a small amount. This representation does not however capture the private fuel sales to freight companies.

Residential (8% of total consumption)

From demographic and population data (WESGRO, 2004) the residential sector can be split into urban and rural settlements, and low income and med-high income groups.

Table 2: Household and electrification data for Western Cape 2004 (WESGRO, 2004)

	Population	Households	Electrified	Unelectrified	% Electrified	% Unelectrified
Rural	546 384	134 218	87 808	46 410	65.4	34.6
Urban	3 977 951	1 039 086	888 084	151 002	85.5	14.5
Total	**4 524 335**	**1 173 304**	**975 892**	**197 412**	**83.2**	**16.8**

Table 3: Household electrification data by income group for Western Cape 2004 (WESGRO, 2004)

	Urban	Rural	Total	%
Medium-high income	407 776	52 672	460 448	39.2
Low income electrified	480 308	35 136	515 741	44.0
Low income non-electrified	151 002	46 410	197 115	16.8
	1 039 086	**134 218**	**1 173 304**	**100**

Most of the population lives in urban settlements with the low income sector making up the largest part. While over 85 % of the urban population live in electrified households, only 65 % of rural households are electrified.

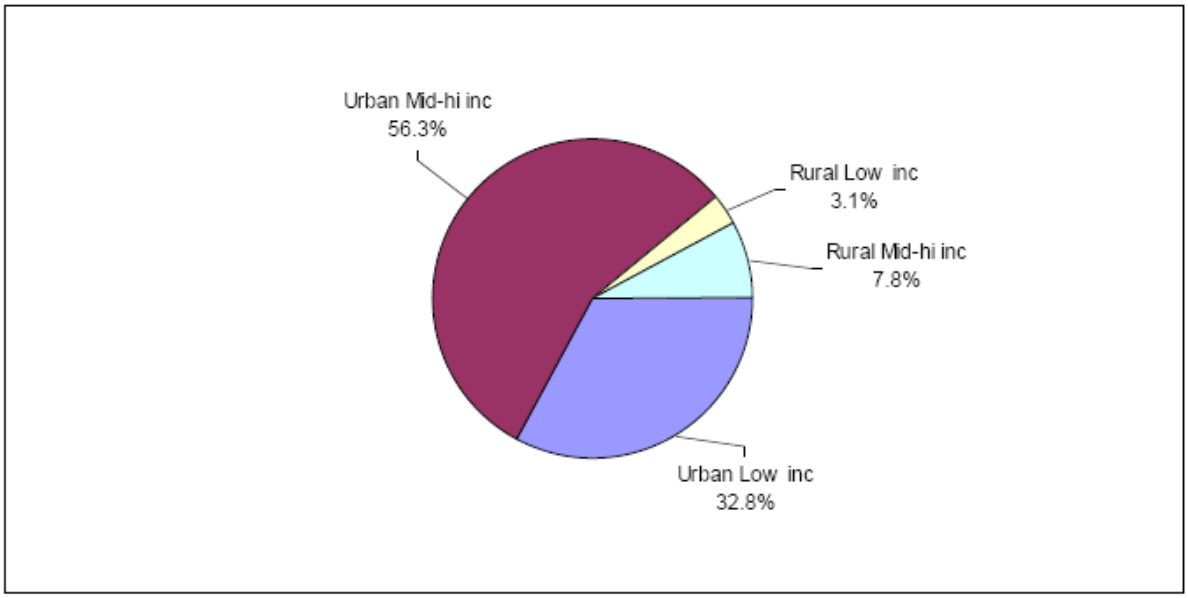

Figure 9: Energy use by sub-sector for the Western Cape residential sector 2004

The urban medium-high income sector is the highest user of energy in the province although the urban low income households are far more numerous. This is due to the high energy use in medium-high income households compared to low income households. Rural households make up a far smaller share due to the relatively small number of rural households in the Province.

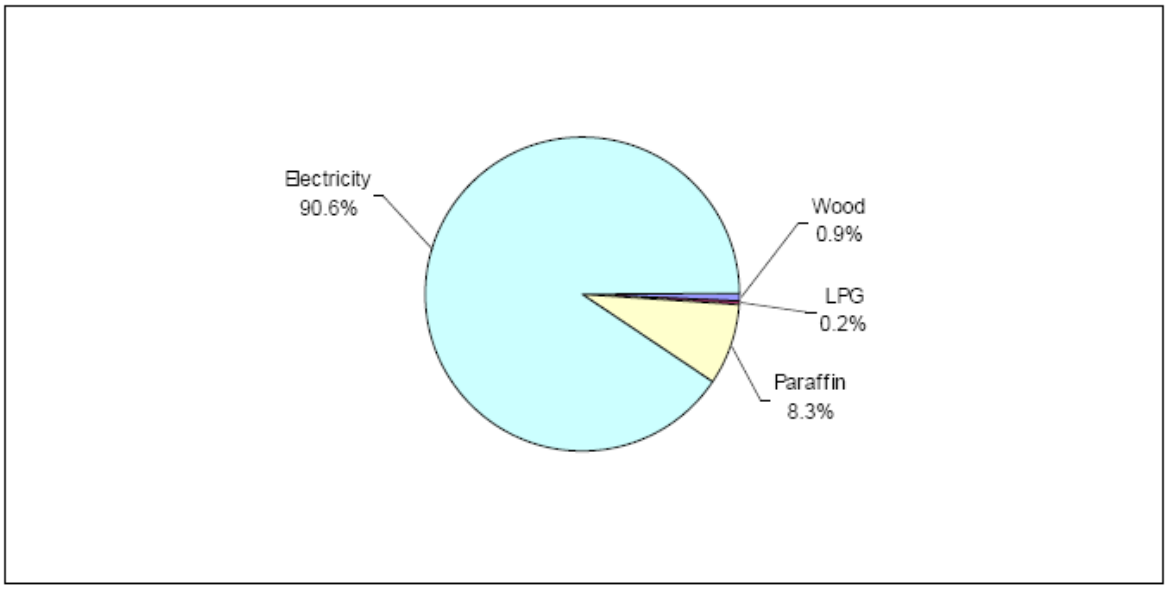

Figure 10: Energy use by sub-sector for the Western Cape residential sector 2004

For the province as a whole, electricity is by far the dominant fuel used in households although paraffin/kerosene and LPG make up a significant part of the fuel mix. Most of the electricity/energy used in medium-high income households is for water heating, while low income households use a far lower proportion of their energy for this end use.

Agriculture (5% of total consumption)

Although the Western Cape is not rich in minerals, it's agricultural and fisheries potential makes up for this. It is one of the most important food baskets of South Africa.

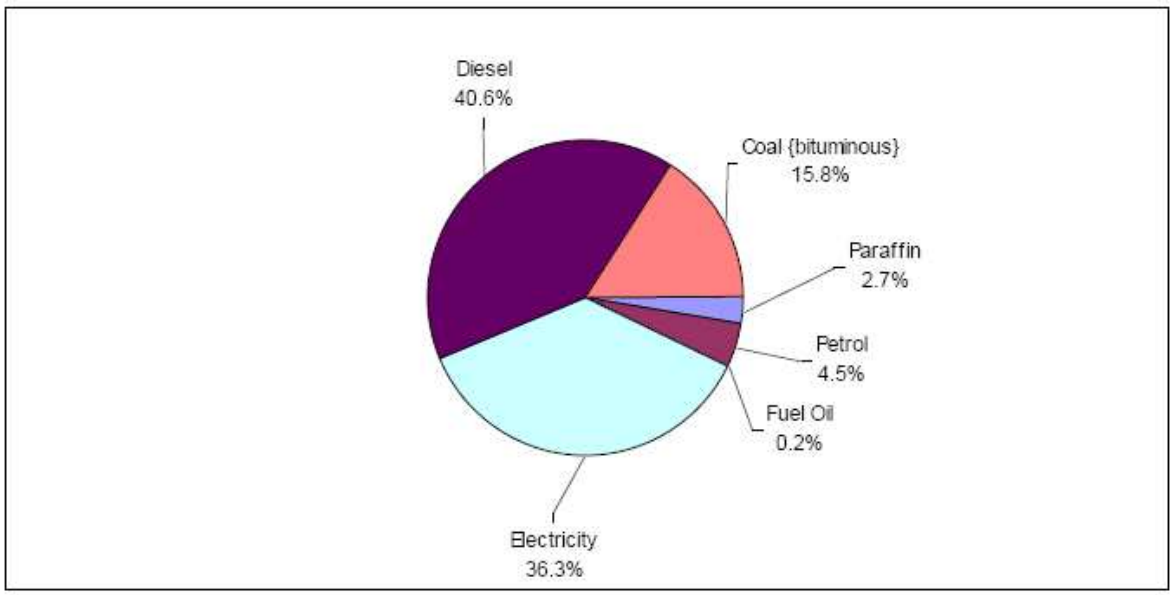

Figure 11: Energy use by fuel for the Western Cape agriculture sector 2004

Diesel is the most important fuel in agriculture but electricity is growing in importance because of the increase of mechanisation.

Commerce and Government (4% of total consumption)

The commercial sector consists of office buildings, hotels, financial institutions, shops, educational facilities, hospital and places of entertainment.

Total electricity use in this sector was split as follows: lighting 26% (1/3 incandescent 2/3 fluorescent), VAC 43%, heating 8%, water heating 3%, refrigeration 5.8%, cooking 0.6%, and other 12.8%.

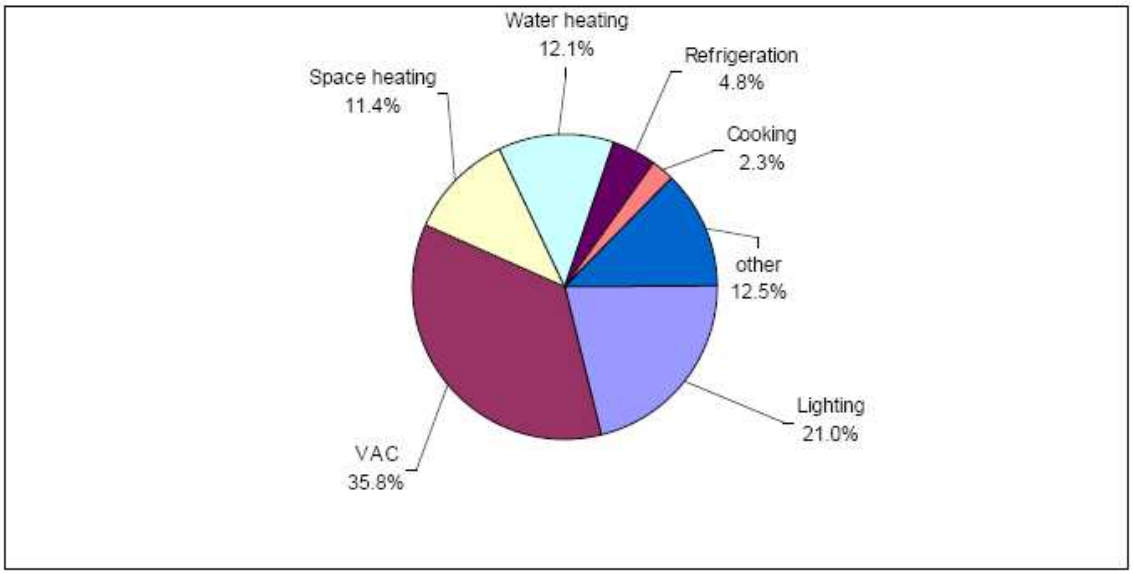

Figure 12: Energy use by end use for the Western Cape commercial and government sectors 2004

Lighting and HVAC (heating, ventilation and cooling) make up most of the energy use in the commercial sector. Government buildings (local, provincial and national) generally have the same energy characteristics as commercial buildings.

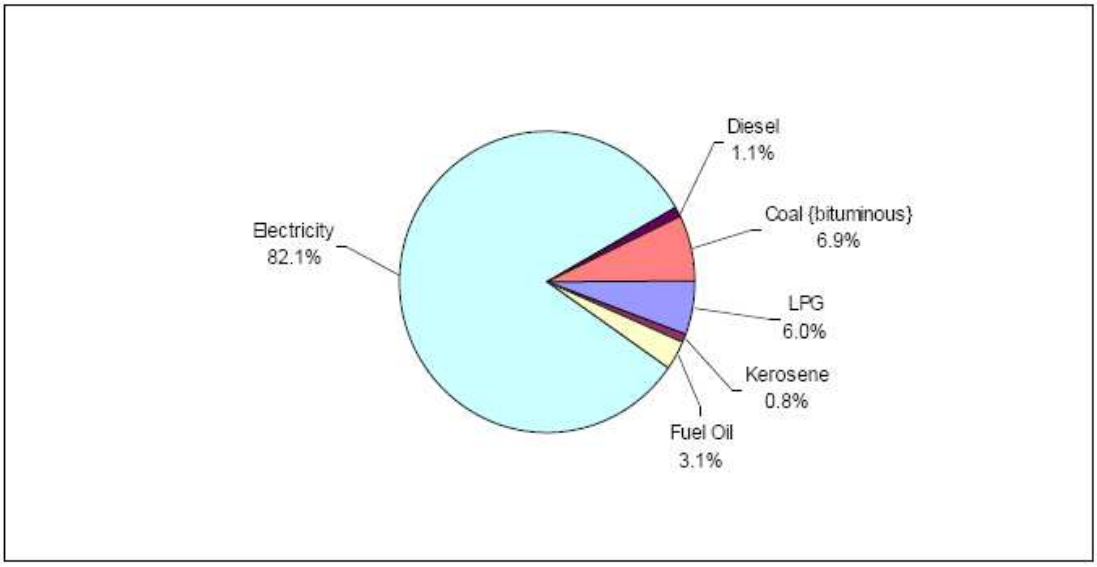

Figure 13: Energy use by end use for the Western Cape commercial and government sectors 2004

Electricity is by far the dominant fuel used in these sectors with coal and liquid fuels making up the remainder.

Mining (2% of total consumption)

The Western Cape is not a mineral rich province, with mainly open cast mining and heavy beach sand operations. The data for this sector was populated in the same manner as described above for industry.

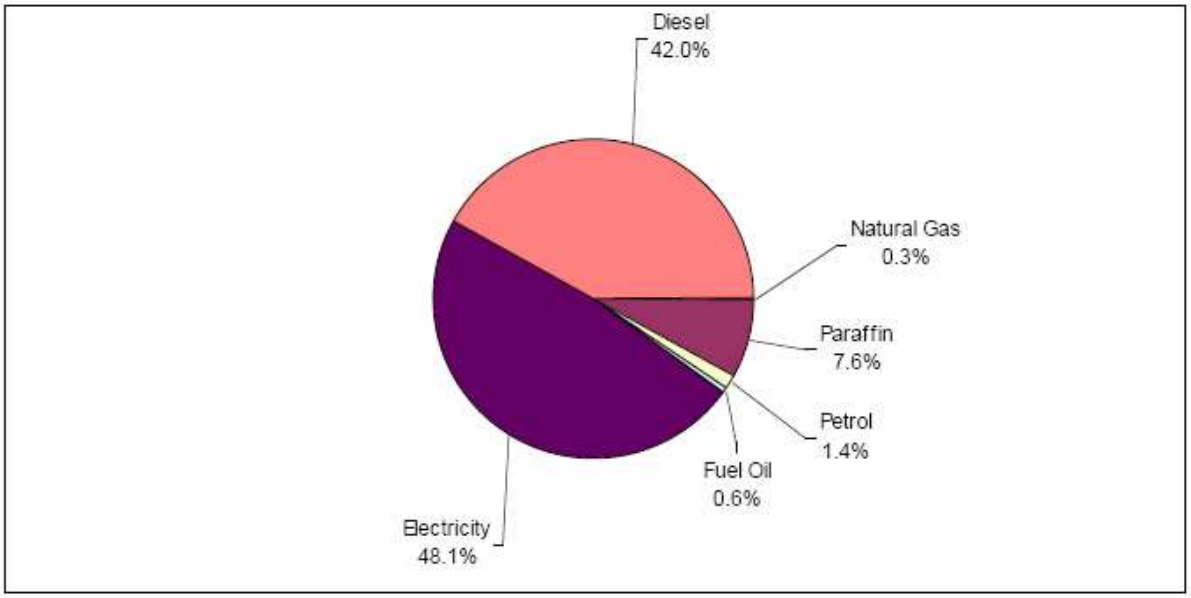

Figure 14: Energy use by fuel for the Western Cape mining sector 2004

The main fuels used in mining were electricity followed closely by diesel.

4 FUTURE DEMAND SIDE AND ENERGY EFFICIENCY SCENARIOS & OPTIONS FOR THE WESTERN CAPE

The following future energy scenarios were created using the Long-Range Alternative Energy Planning modelling software.

Long-Range Energy Alternative Planning (LEAP) modelling

The simulation model, the Long-Range Energy Alternatives Planning (LEAP[1]), was used to simulate how energy might develop in the Western Cape over the next 20 years. LEAP is an accounting framework, which rather than trying to optimise a system's behaviour, it helps the user account for the implications of "what if" questions. These developments are driven not only by the nature of the energy sector itself, but also by broader factors, notably population growth, household size, economic-growth (which may vary by sector) and other factors. Various 'scenarios' were developed and entered into the model based on the strategy targets, in order to assess the implications of meeting the targets. The target scenarios were then compared with the reference case – or 'business as usual', where no such interventions were pursued. This sometimes led to the revision of targets to be more realistic.

The Future Energy Scenarios, developed by Sustainable Energy Africa and Incite Sustainability, along with input from the reference team and members of various Provincial Government Departments, have helped shape the energy strategy in a significant manner. A range of implementation scenarios were modelled to assess their impact and feasibility.

Transport

The energy profiles in the previous sections highlight the fact that liquid fuels and the transport sector make up a large portion of the total energy use in the province. There is significant scope for intervention in this sector that would have dramatic environmental and financial impacts. Some of the possible future transport interventions are illustrated below.

Modal shift

In the base year (2004) passenger-km[3] splits for passenger transport were 38 % private vehicles and 62% public transport. This is in contrast to the fuel use splits for 2004 where private transport uses approximately 78 % of the energy in passenger transport.

[3] Passenger-km: number of passengers times by number of km over which they travel (a common transport analysis unit)

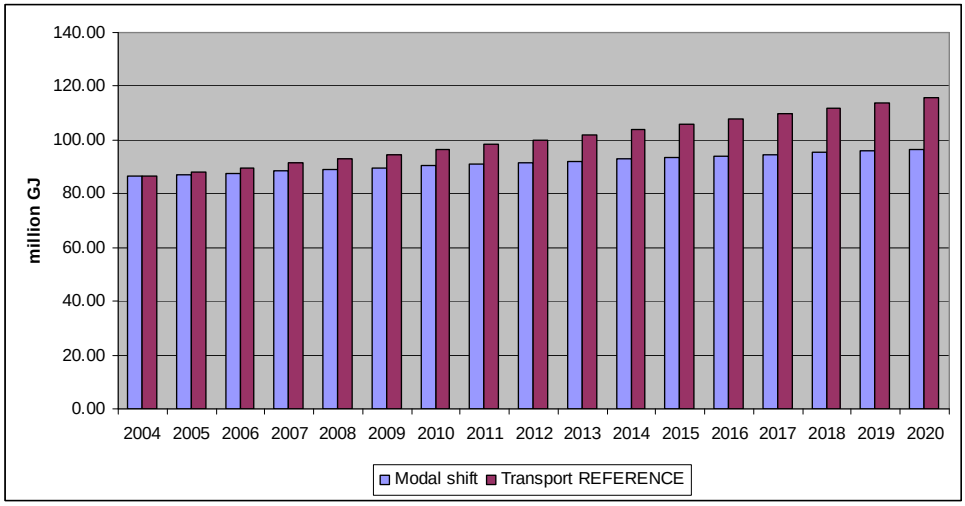

Figure 15: Energy use in passenger transport for the reference and modal shift scenarios

Such a shift implies massive changes in infrastructures, the costs of which are not reflected here but are addressed in the Strategic Infrastructure Plan. The cost of the fuel saved has been calculated for this scenario

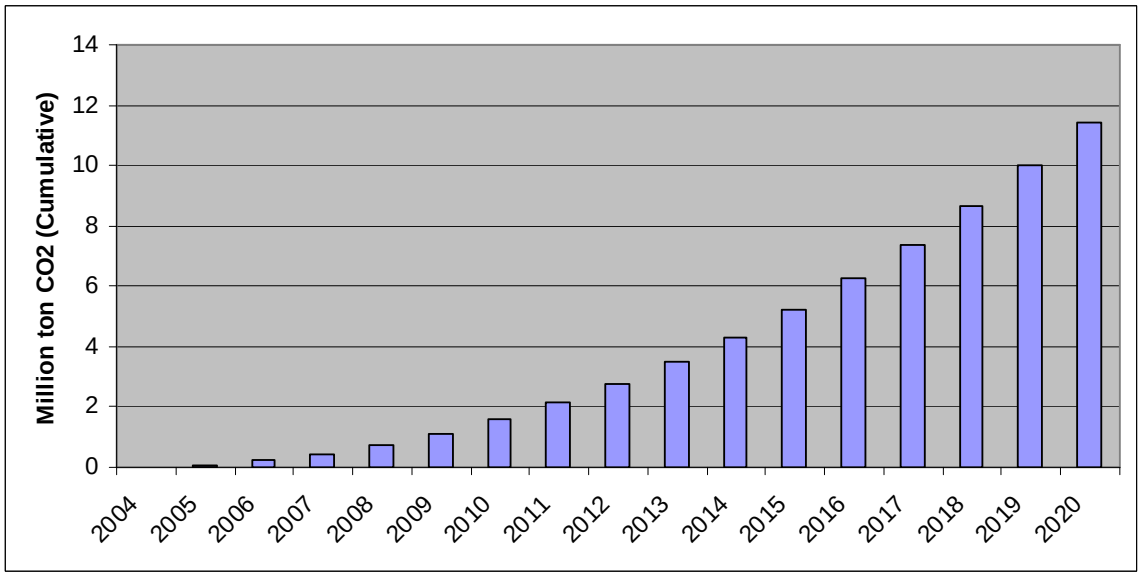

Figure 16: CO_2-eq emissions in passenger transport for the reference and modal shift scenarios

Similar trends can be observed for CO_2-eq emissions for the modal shift scenario. Note that the above figure on scenario CO_2eq reductions includes refinery emissions, not only emissions that occur where the fuel is combusted.

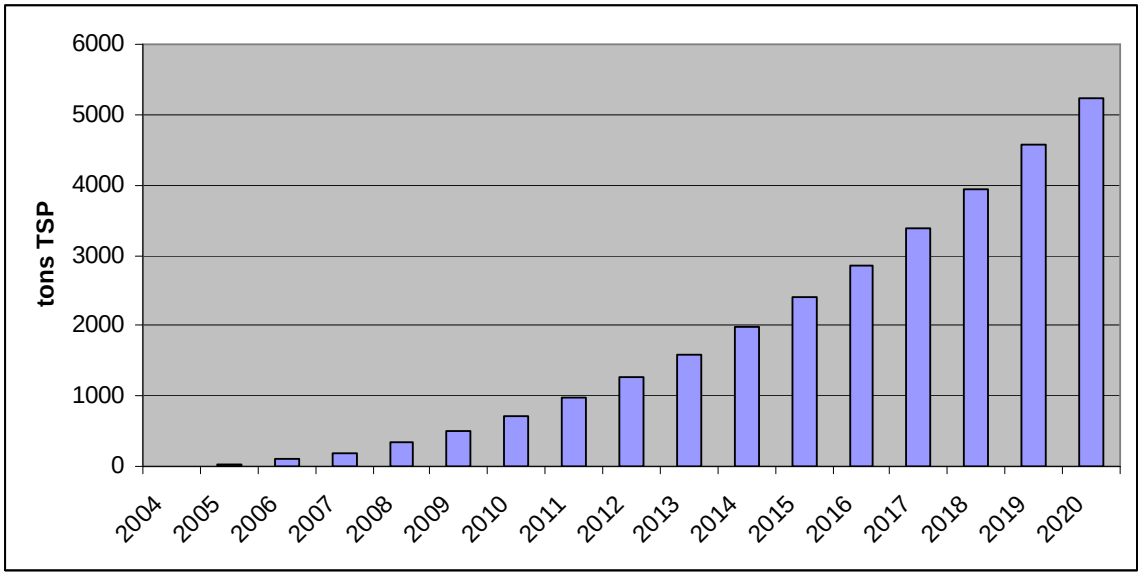

Figure 17: Total Suspended Particulate (TSP) emissions reductions in passenger transport for the modal shift scenario

The modal shift also results in a significant decrease in total suspended particulates (TSP) compared to the reference case.

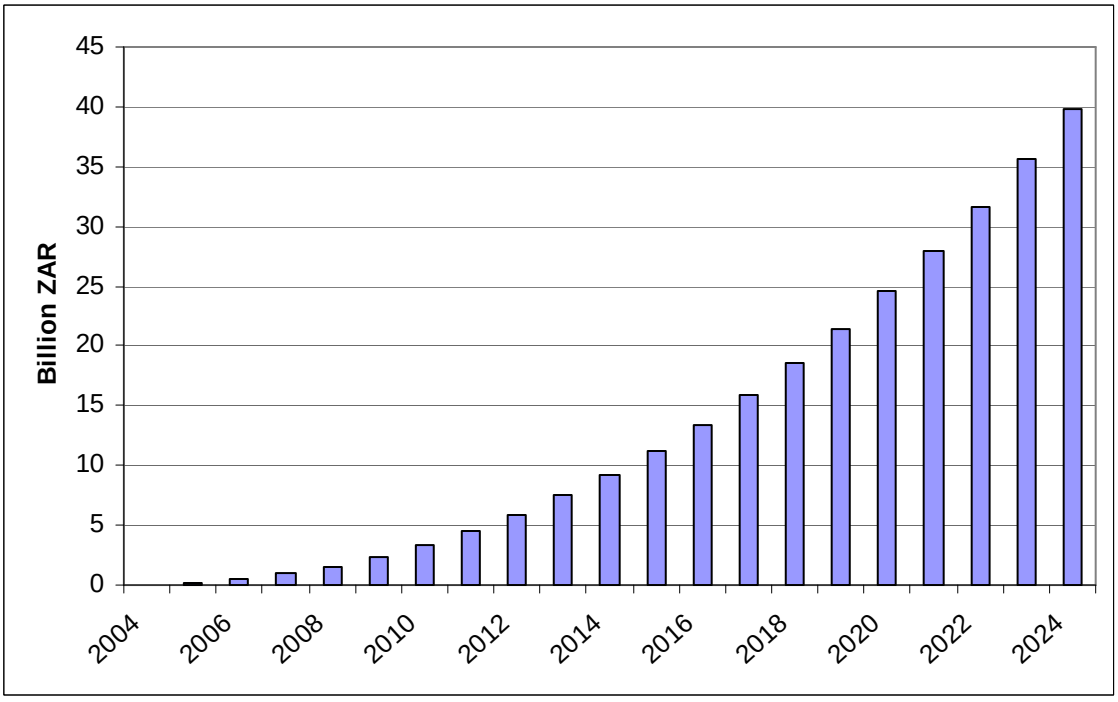

Figure 18: Cumulative financial savings for the modal shift scenario

The cumulative savings for the modal shift scenario are massive and reach almost R40 billion by the end of the time horizon. The cost of the infrastructure changes required for this modal shift have not been calculated but clearly the fuel savings alone could help subsidise those changes.

Taxi shift to diesel

This policy option simulates the effects of a shift from petrol to diesel minibus taxis (which is the intention with the 'taxi recapitalisation' programme). It is assumed that this policy results in *diesel taxis* increasing their share from 38.2 % in the base year to 100% by the end of the time horizon.

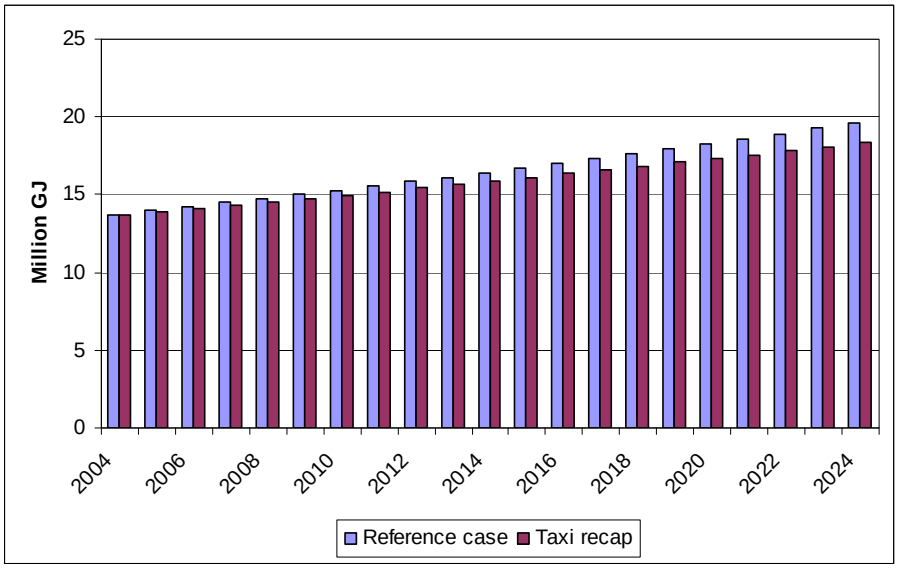

Figure 19: Energy use by minibus taxis for the reference and modal shift scenarios

It can be seen that there is a gradual increase in annual energy savings when comparing the scenario of taxis shifting to diesel with the reference case. This is due to the increased energy efficiency of diesel vehicles as opposed to petrol vehicles.

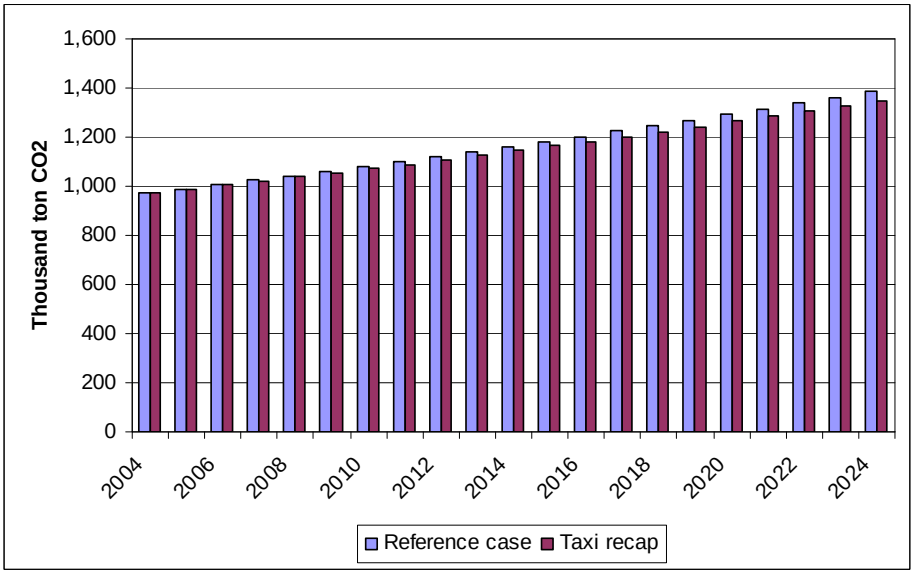

Figure 20: CO_2-eq emissions from minibus taxis for the reference and modal shift scenarios

Similar trends occur for CO_2-eq emissions for the taxi recapitalisation/shift to diesel scenario. The total CO_2-eq cumulative emissions savings are 0.92 million tons in 2020. This includes refinery emissions, not only emissions that occur where the fuel is combusted.

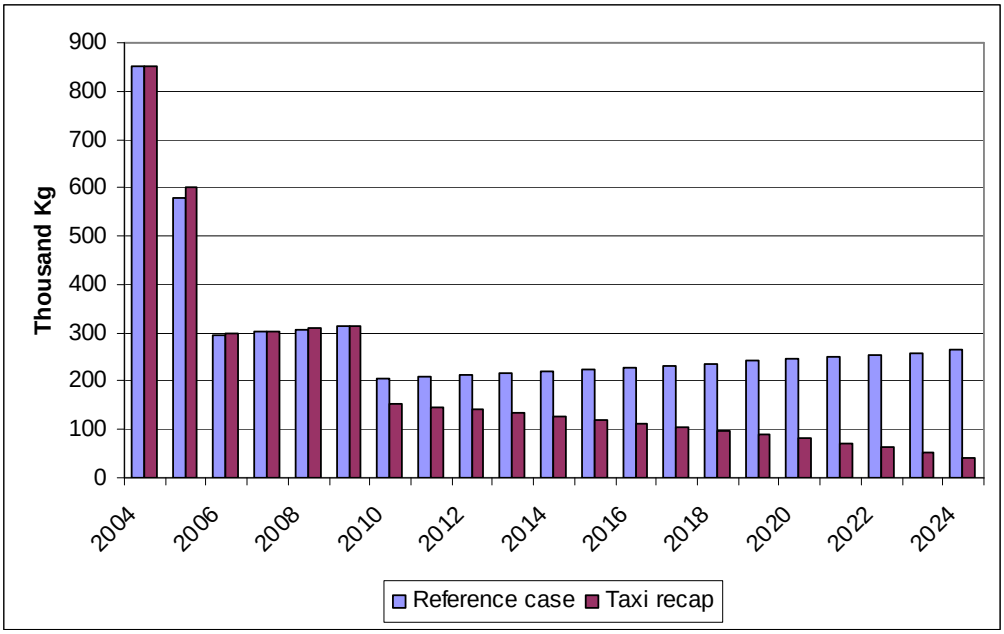

Figure 21: Sulphur Dioxide (SO_2) emissions from minibus taxis for the reference and modal shift scenarios

The taxi shift to diesel scenario results in a significant decrease in SO_2 emissions after 2010. This effect is a combination of the increased number of diesel taxis and the shift to very low sulphur diesel which is programmed for 2010.

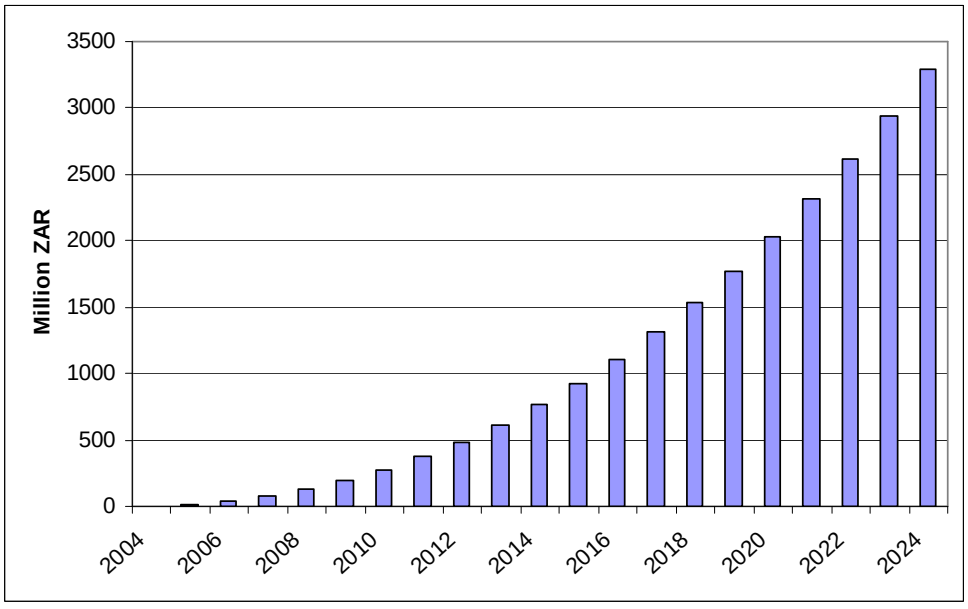

Figure 22: Cumulative energy savings for the taxi recapitalisation scenario

The cumulative savings for the taxi recapitalisation scenario are significant and reach over R3 billion by the end of the time horizon. The cost of the infrastructure changes required for this scenario has not been calculated.

Industry

Energy efficiency

In this scenario industry has a 20% improvement in energy efficiency by 2015, which increases linearly from the base year. After 2015, the energy intensity of all industries remains constant. The efficiency improvements occur in electricity demand devices as well as suppliers of thermal heat. The improvements are likely to come from lighting, compressed air, motors, variable speed drives, improved boiler efficiency as well as steam system efficiency.

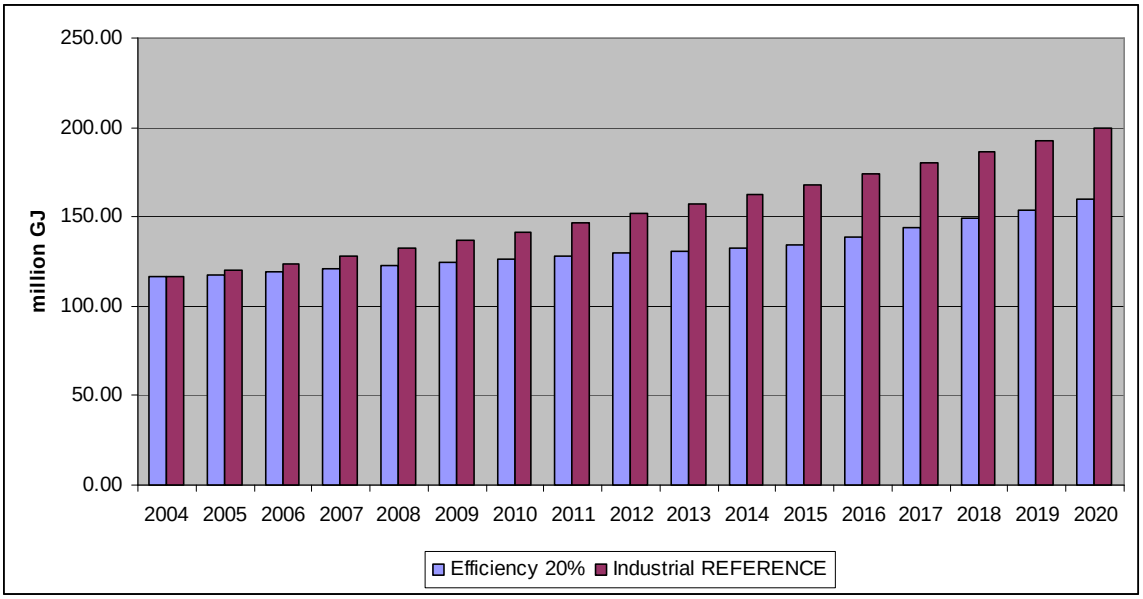

Figure 23: Energy use in the industry sector for the reference and energy efficiency scenarios

A significant increase in annual energy savings can be observed when comparing the energy efficiency scenario to the reference case. The cumulative energy savings by 2020 for the energy efficiency scenario was more than 367 million GJ when compared to the reference case.

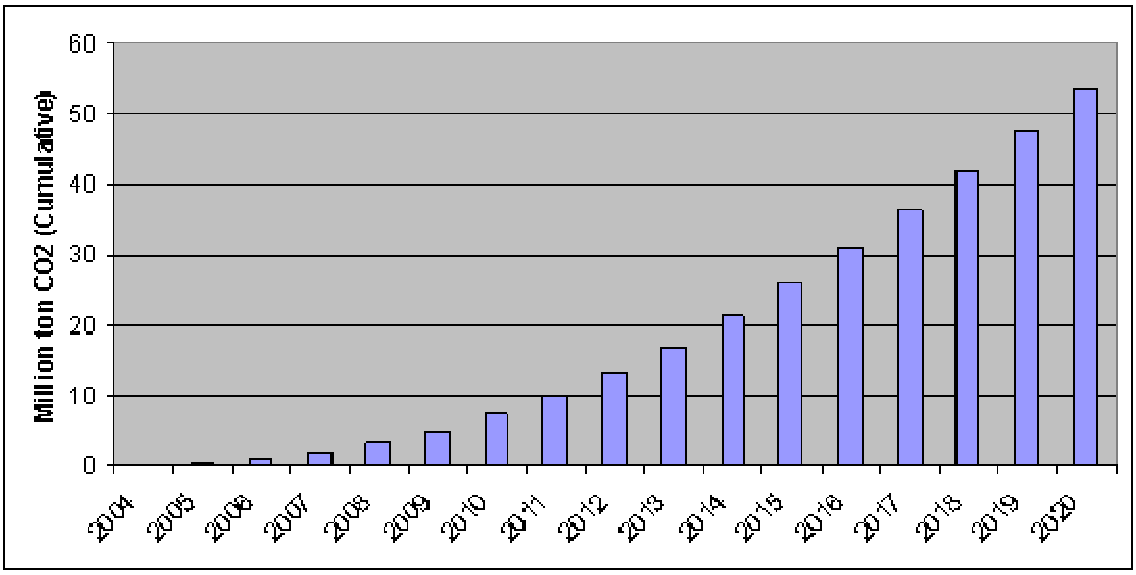

Figure 24: CO_2-eq emissions from the industry sector for the reference and energy efficiency scenarios

Similar trends can be observed for CO_2-eq emissions when comparing the energy efficiency scenario to the reference case resulting in a cumulative CO_2-eq emissions savings of more than 35 million tons.

Fuel switching

In this scenario fuel switching takes place between coal and natural gas only. The scenario takes effect in 2004 and by 2024, the end of the time horizon, half of all thermal energy demand supplied by coal is replaced by natural gas.

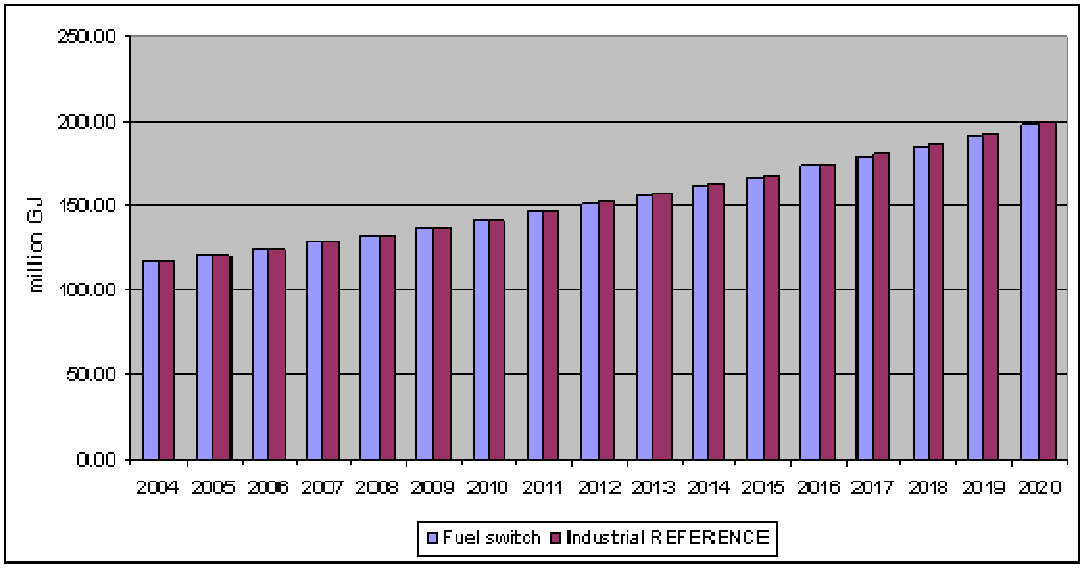

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Figure 25: Energy use in the industry sector for the reference and fuel switching scenarios

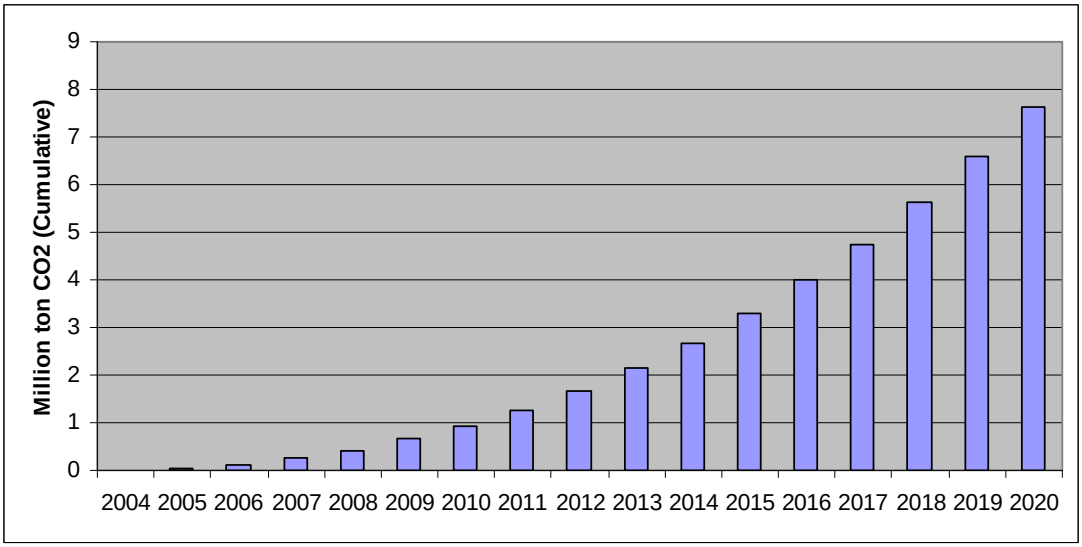

Figure 26: Cumulative CO_2-eq emissions savings from the industry sector for the reference and fuel switching scenarios

A more significant decrease can be seen in CO_2-eq emissions when comparing the fuel switching scenario to the reference case. A cumulative CO_2-eq emissions savings of just over 7 million tons could be expected for the fuel switching scenario

Commerce and Government

Lighting

In commercial and government buildings, both fluorescent tubes and 'regular' lighting is currently used. Regular incandescent light bulbs may be replaced by the more efficient compact fluorescent lights.

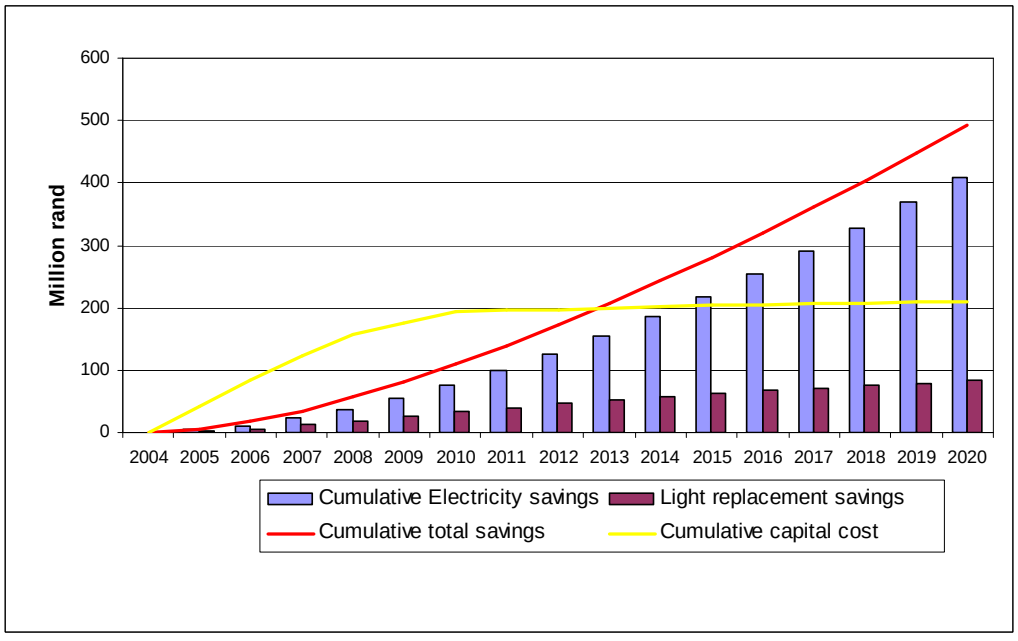

Figure 27: Cumulative costs and savings for the lighting scenario in the commercial sector relative to the reference case

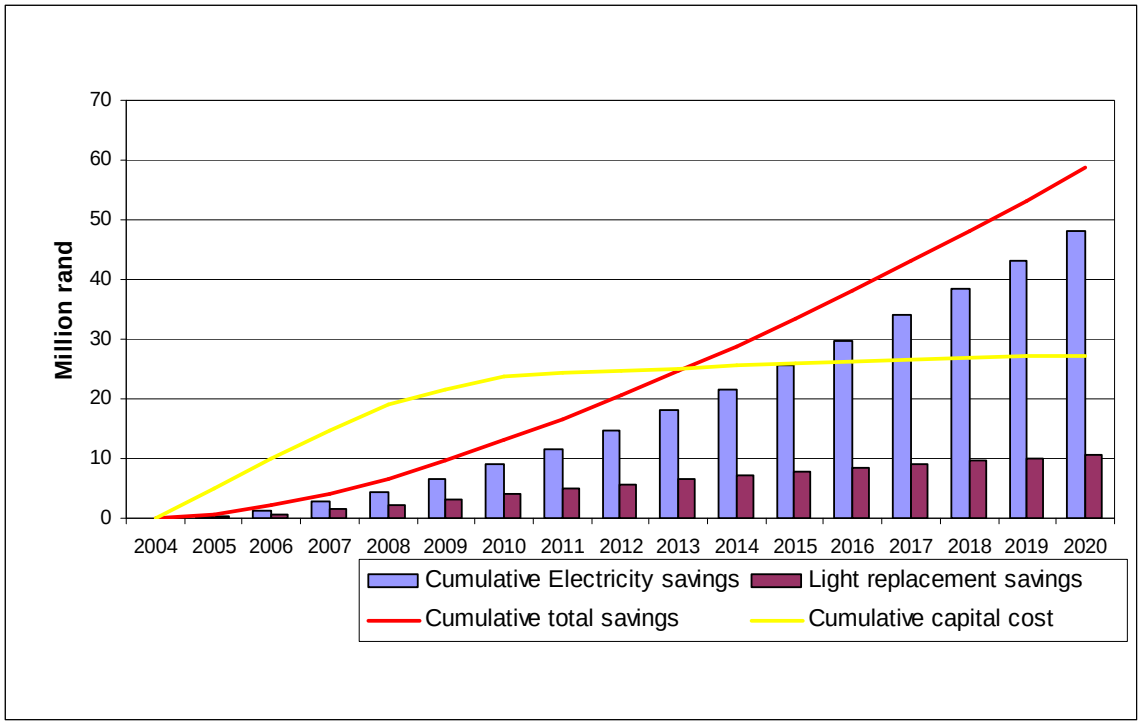

Figure 28: Cumulative costs and savings for the lighting scenario in the government sector relative to the reference case

It can be seen that the lighting scenario results in large savings in both the commercial and government sectors. The combination of the energy savings from using more efficient devices and the light replacement savings from the longer lifespan of the Cols compared to the incandescent light bulbs far outweigh the higher cost of the CFL's compared to the incandescent light bulbs.

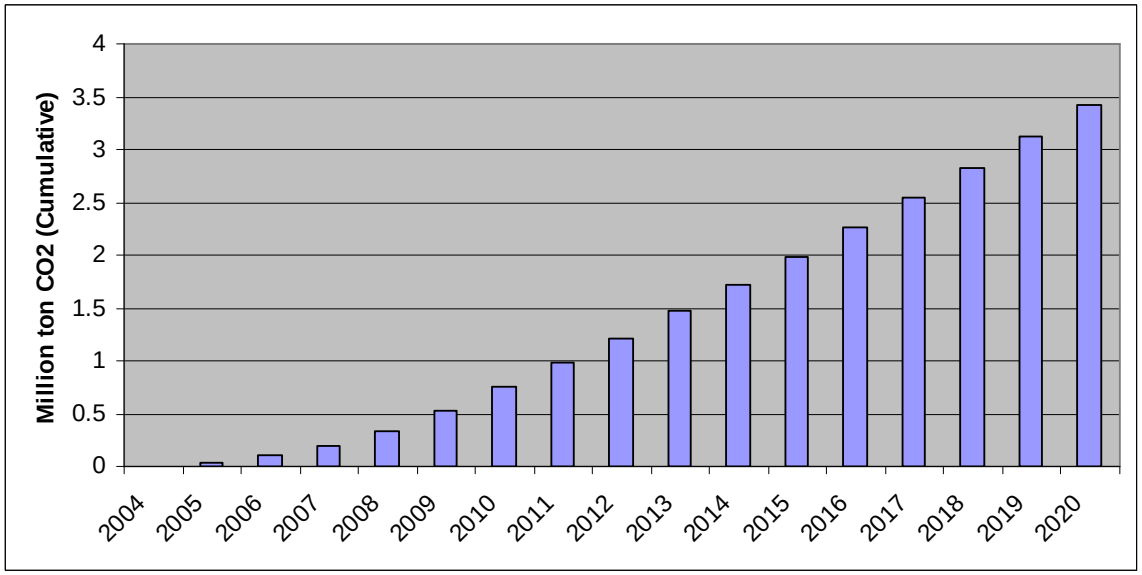

Figure 29: Cumulative CO_2-eq savings for the commercial sector for the lighting scenario relative to the reference scenario

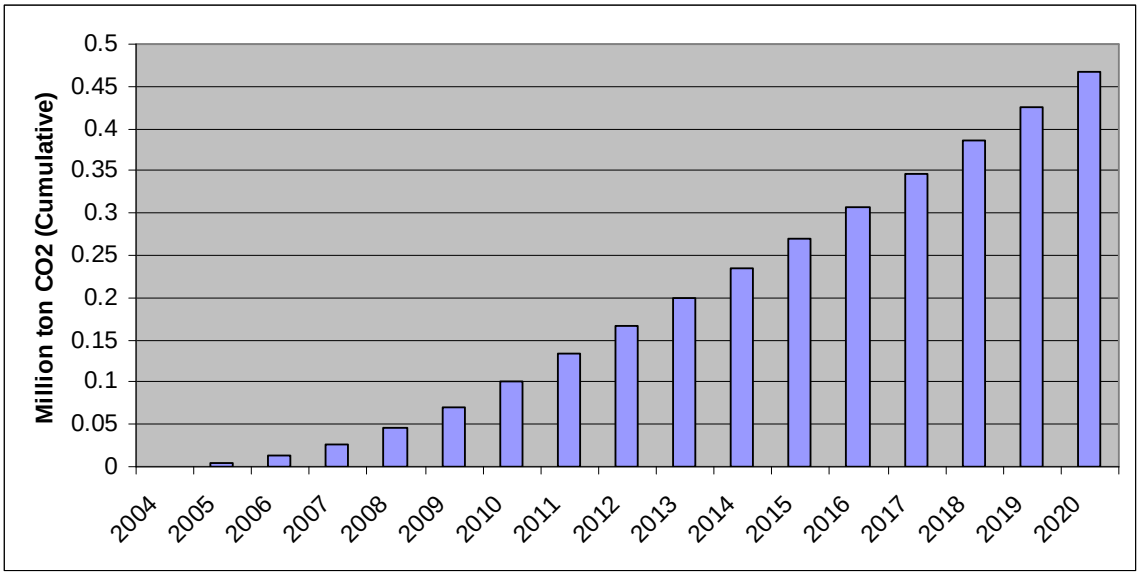

Figure 30: Cumulative CO_2-eq savings for the government sector for the lighting scenario relative to the reference scenario

Significant savings in CO_2-eq emissions can be observed in both the commercial and government sectors for the lighting scenario.

Heating, ventilation and cooling (HVAC)

Experience with audits in the government and commercial sectors has shown that improving efficiency of HVAC use by 10% by user behaviour change can relatively easily be achieved (Monamodi & Borchers 2003).

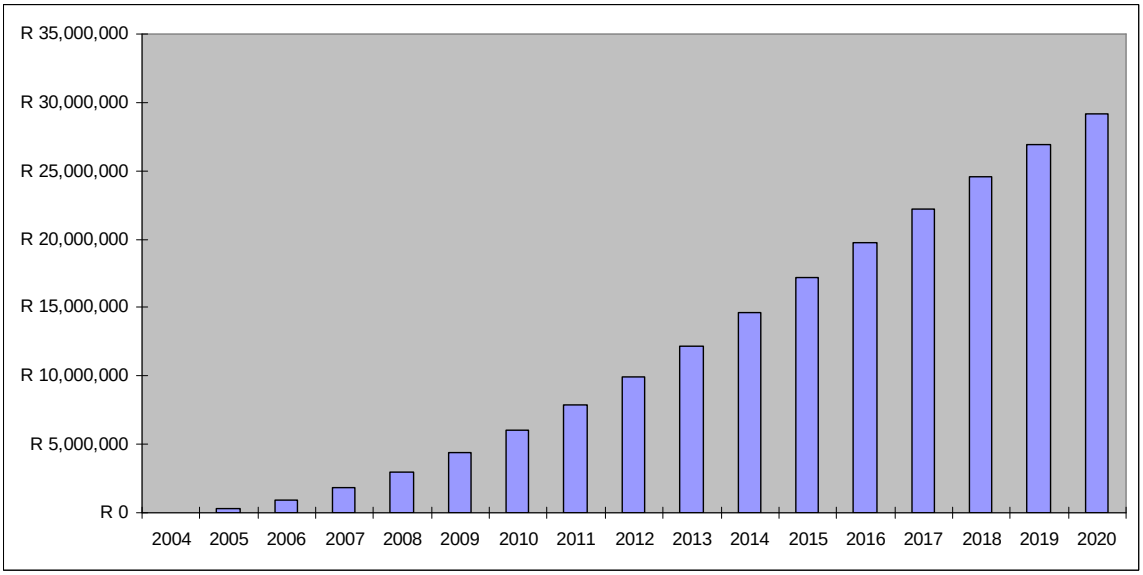

Figure 31: Cumulative energy savings for the HVAC scenario in the government sector relative to the reference case

Cumulative energy savings of over 200 million rand in the commercial sector and 29 million rand in the government sector could be expected for the HVAC scenario by 2020.

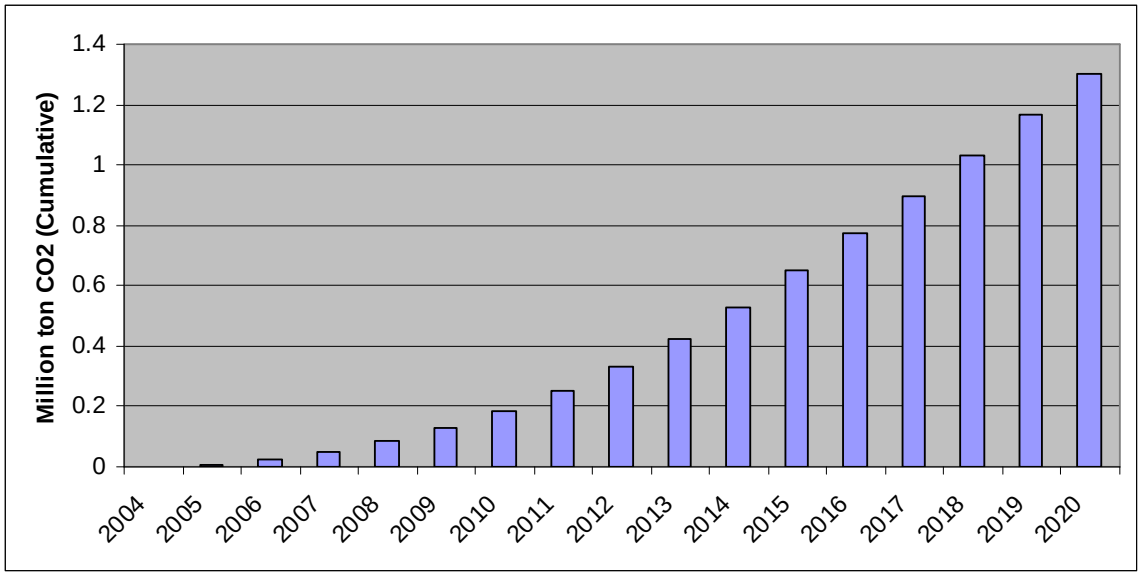

Figure 32: Cumulative CO_2-eq emission savings for the commercial sector for the HVAC scenario relative to the reference scenario

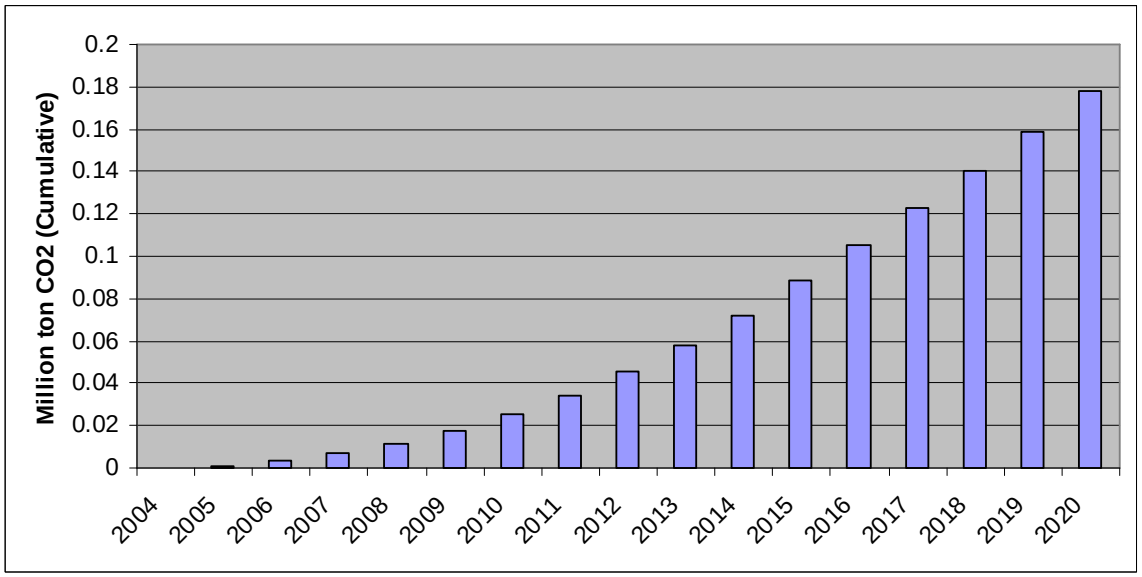

Figure 33: Cumulative CO_2-eq emission savings for the government sector for the HVAC scenario relative to the reference scenario

Cumulative savings in CO_2-eq emissions of over 1.2 million tons in the commercial sector and 180 thousand tons in the government sector could be expected for the HVAC scenario by 2020.

Residential

Solar water heaters

The solar water heater(SWH) scenario assumed that 10 % of electric geysers were replaced by solar water heaters by 2015 in electrified households, and 50% by 2024. For low income households, a solar fraction of 80% was assumed due to the typically reduced hot water use of such households, and therefore the greater ability of the SWH to meet most water heating needs.

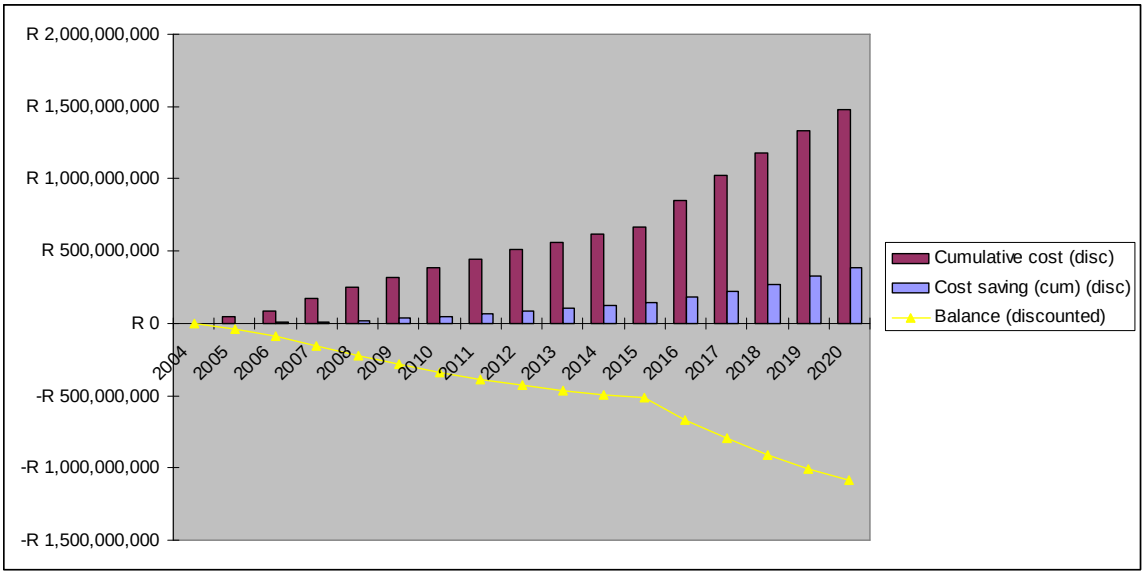

Figure 34: Cumulative costs and savings from rolling out a mass SWH programme

The figure shows that implementing a large-scale SWH programme will be resource demanding.

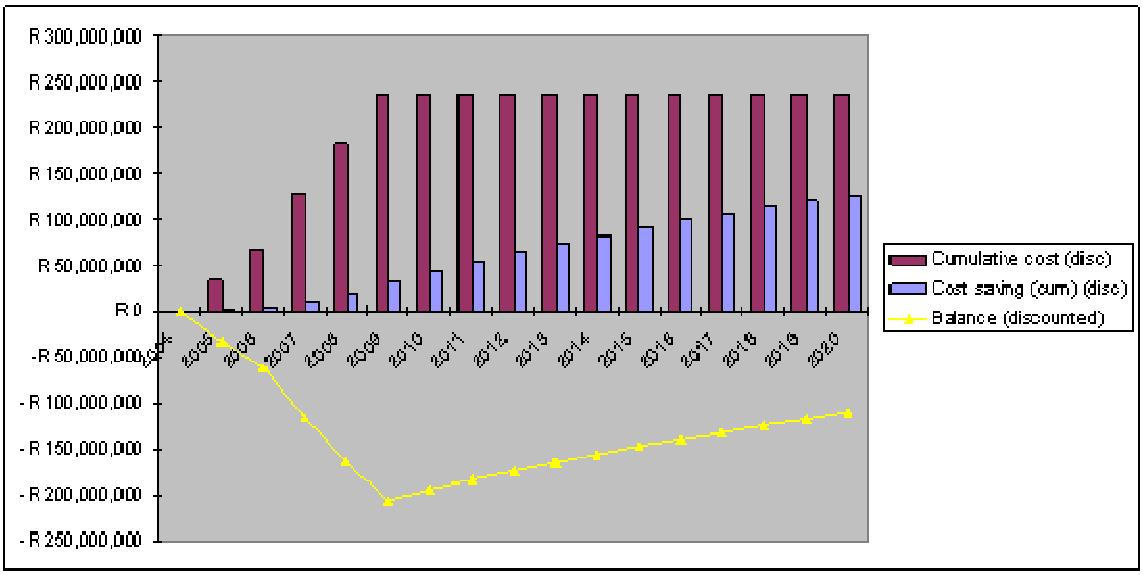

Figure 35: Cumulative costs and savings from a mass SWH programme – where investment in new systems stops at 2010)

The financial viability of installing systems in low income as opposed to med-high income households is shown in the below figures.

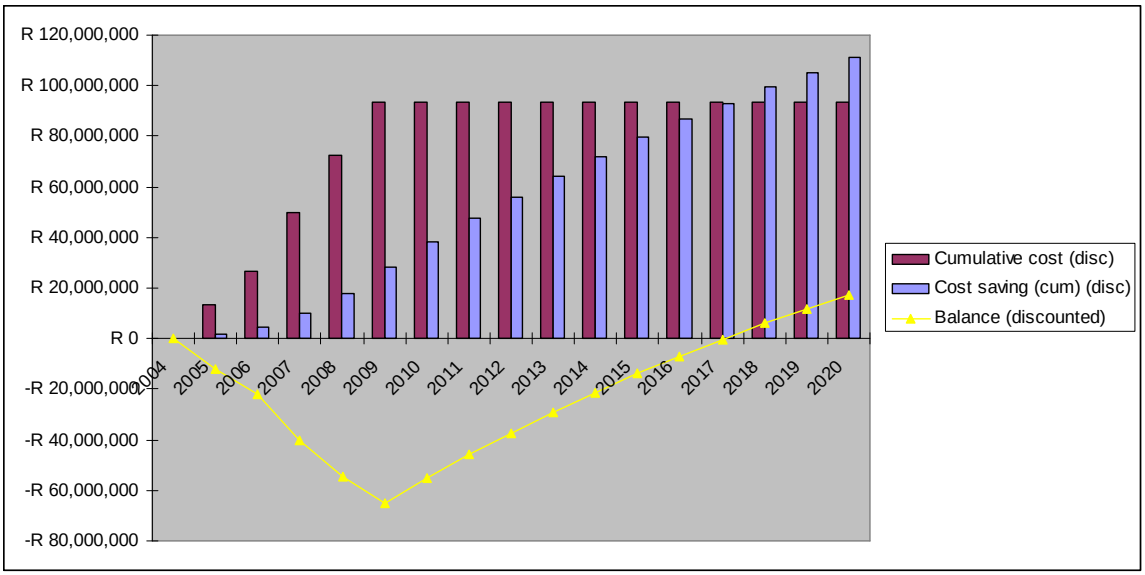

Figure 36: Cumulative costs and savings from a mass SWH programme – where investment in new systems stops at 2010 – med-high income sector only

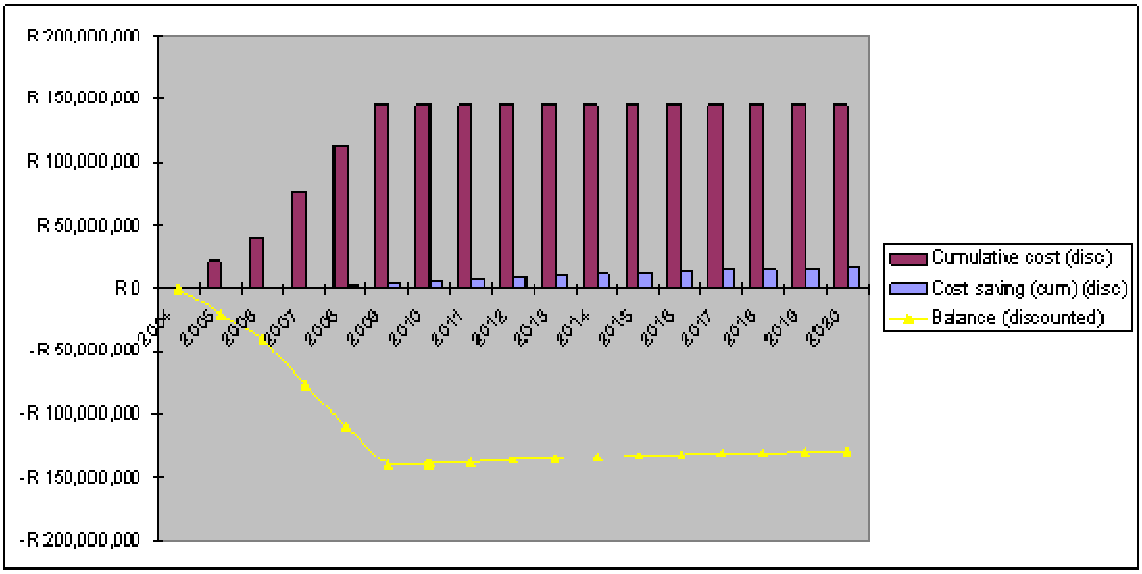

Figure 37: Cumulative costs and savings from a mass SWH programme – where investment in new systems stops at 2010 – low income sector only

The results for implementing a solar water heating programme in the low income households may not be financially attractive, in contrast to the medium-high income sector as low income households use less electricity for water heating than medium-high income households. There are also numerous other benefits to installing SWH's in this income group, including health and welfare benefits.

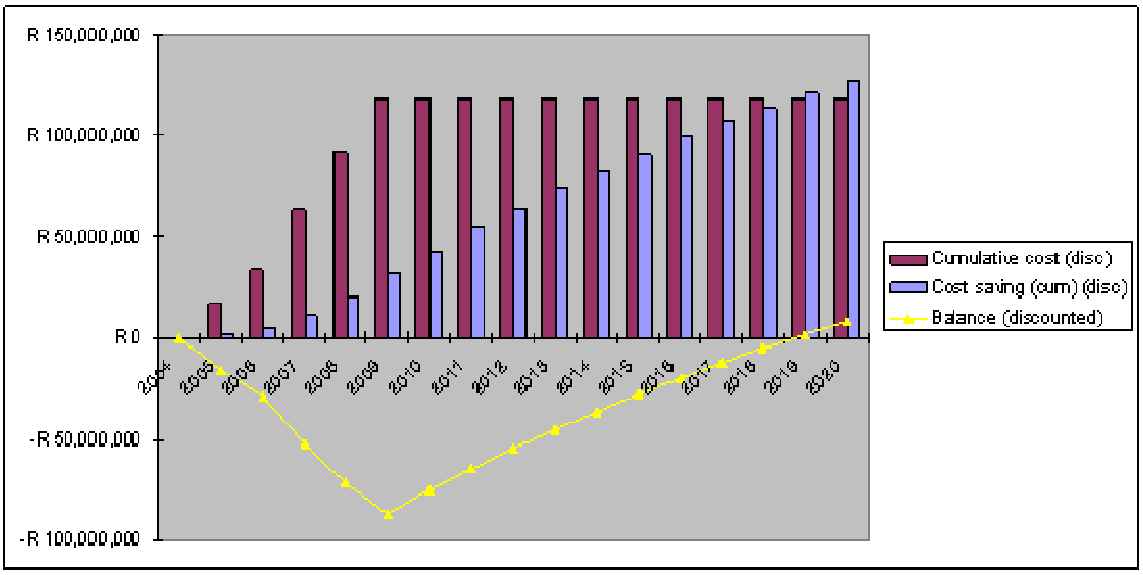

Figure 38: Cumulative costs and savings from a mass SWH programme – where investment in new systems stops at 2010 – system cost of R3000 achieved.

If however the cost per solar water heating unit was reduced to R3000, the programme savings would become positive by 2018 for the residential sector as a whole.

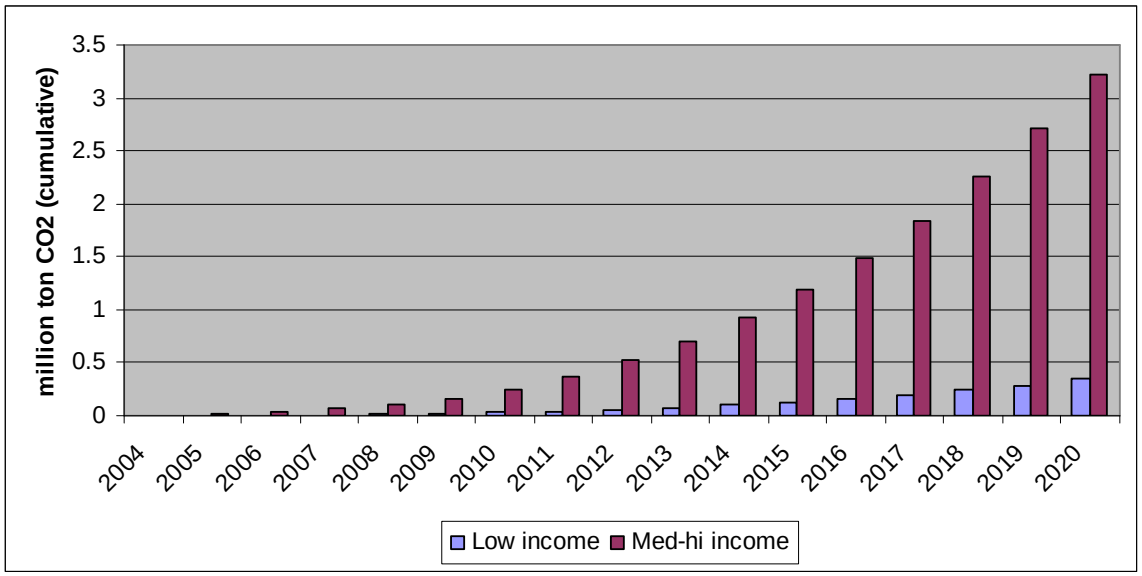

Figure 39: Cumulative CO_2-eq emission savings from a solar water heater programme in the residential sector

A cumulative savings of over 3 million tons of CO_2-eq emissions by 2020 would result from implementing a solar water heating programme in the medium-high income sector, as well as a cumulative savings of over 340 thousand tons of CO_2-eq emissions in the low income sector.

Residential lighting

This scenario simulates a shift from incandescent lights to CFL's in all electrified households by 2010. A two bulb retrofit was assumed for low income households (1x16W and 1x11W) while a four bulb retrofit was assumed for medium-high income households (4x16W).

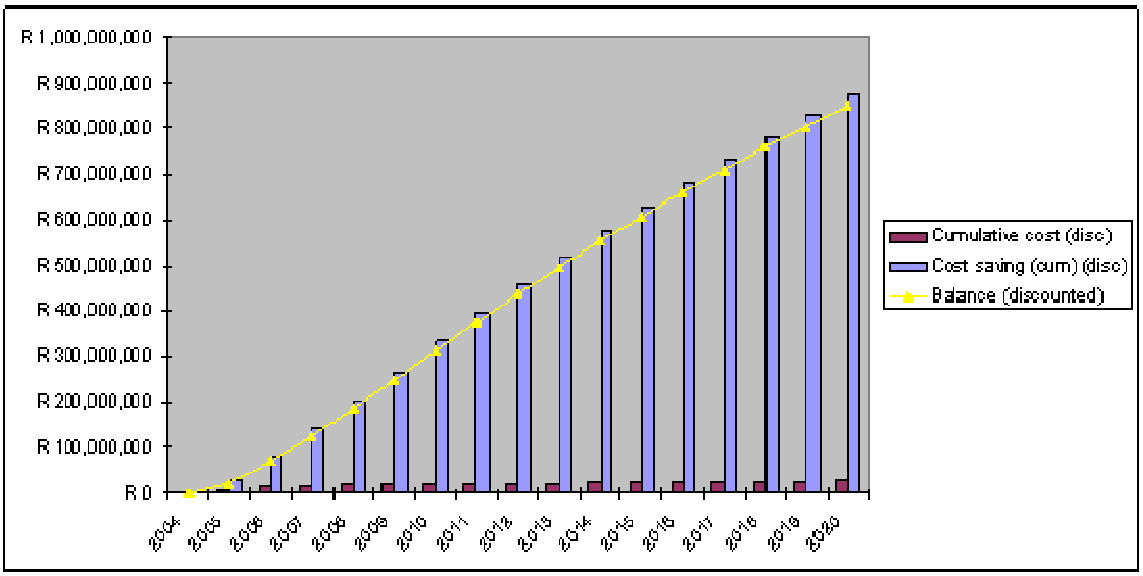

Figure 40: Cumulative costs and savings for the residential lighting scenario in all income group households relative to the reference case

The residential lighting scenario results in enormous energy savings in both the medium-high and low income sectors. The combination of the energy savings from using more efficient devices and the light replacement savings from the longer lifespan of the CFL's compared to the incandescent light bulbs far outweigh the higher cost of the CFL's compared to the incandescent light bulbs.

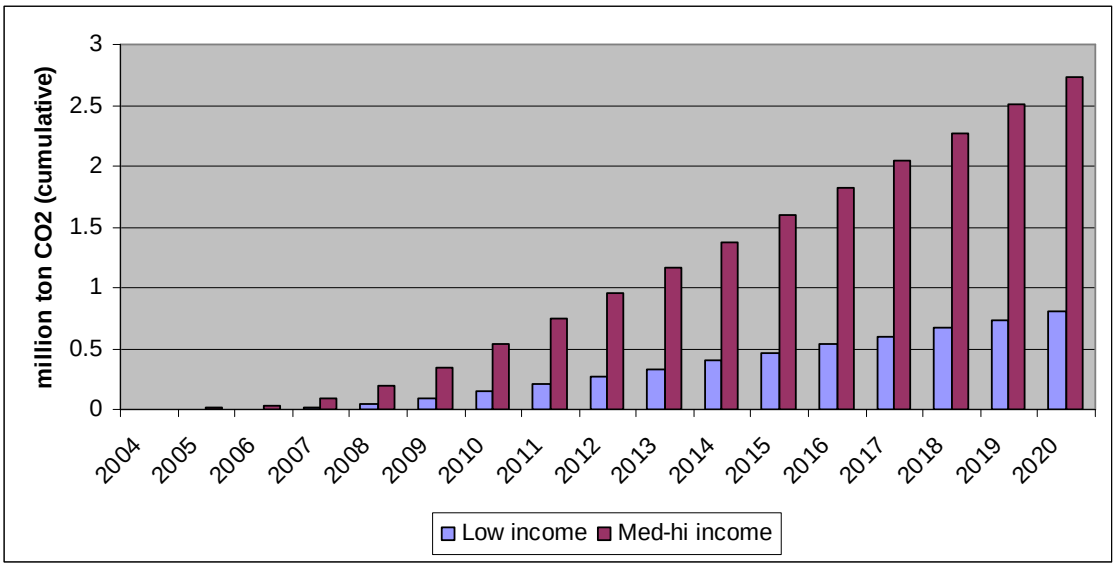

Figure 41: Cumulative CO_2-eq emission savings for the residential lighting scenario relative to the reference case

Cumulative CO2-eq emission savings of 2.7 million tons could be expected in the residential lighting scenario in the medium-high income sector and almost 0.8 million tons in the low income sector by 2020. The installation of ceilings in low income households would result in less thermal energy being required which in turn would lead to less electricity and other fuel being consumed for space heating.

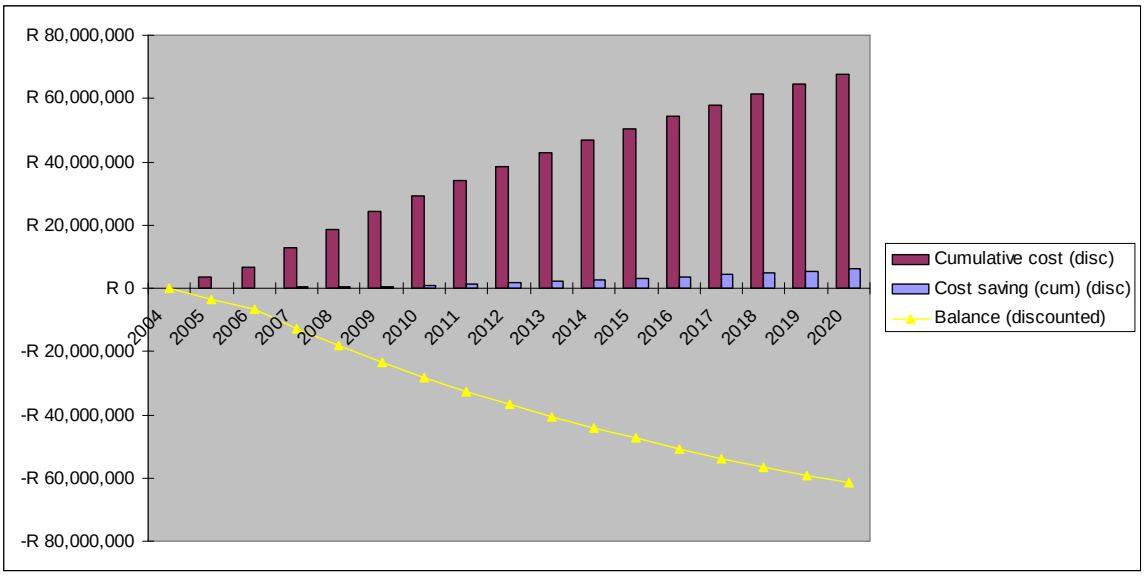

Figure 42: Cumulative costs and savings for the residential ceiling scenario relative to the reference case

The energy savings in the residential ceiling scenario do not outweigh the capital cost of the ceiling installation and result in a cumulative cost of over 60 million Rand by 2020. Against this financial assessment must be weighed the significant health and comfort benefits of ceilings in households.

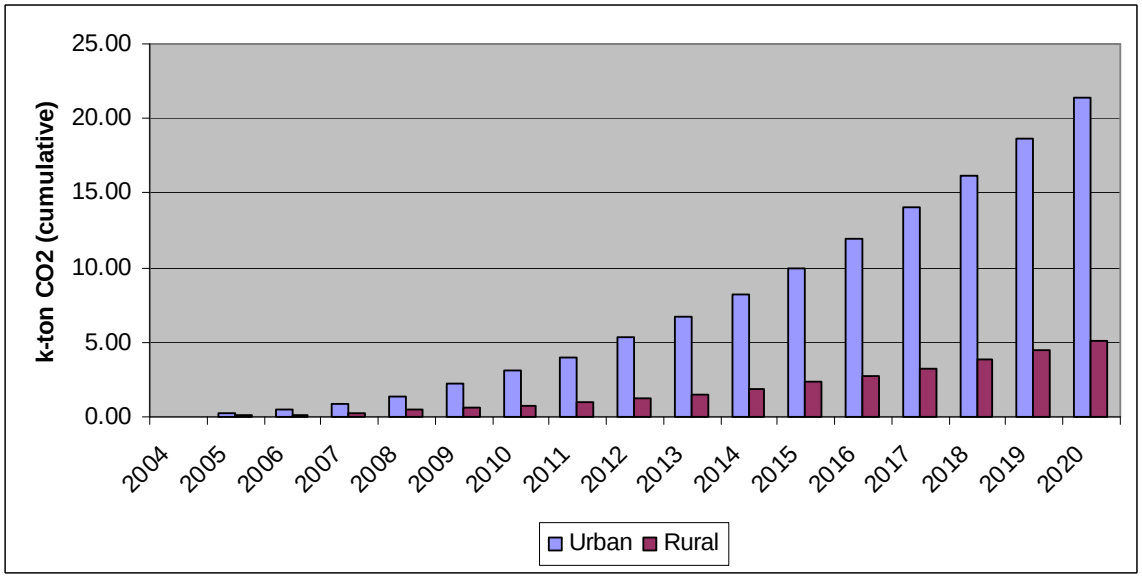

Figure 43: Cumulative CO_2-eq emission savings for the residential ceiling scenario relative to the reference case

The residential ceilings scenario resulted in a cumulative savings of 21 thousand tons of CO_2-eq emissions in urban households and a cumulative savings of 5 thousand tons of CO_2-eq emissions in rural households by 2020.

Summary of Scenarios and Implications for Municipal Regions

The table below highlights the scenarios modelled as part of the development of the energy strategy and objectives. This forms the basis of the interventions supporting the Provincial Government's energy strategy aimed at these sectors.

Table 4: Summary of Key actions

Scenario	Energy '000 GJ	CO2 k-tons	SO2 tons	Tot suspended particulates tons	Financial savings or costs at 2020 ZAR million
Taxis to diesel	7,314	287	1,128		3,291*
Transport modal shift	152,393	11,449	4,620	5,244	39,839*
ALL Transport	159,707	11,736	5,748	5,244	43,130
SWH residential	11,314	3,576	-	-	-1,100**
Ceilings	117	26	-	6	-60
CFL residential	11,232	3,532	-	-	800
ALL Residential	22,663	7,134		6	-360
Industry fuel switch	9,116	7,631	-	-	-
Industry efficiency	367,055	53,427	45,936	-	-
ALL Industry	376,171	61,058	45,936		
HVAC commercial	4,133	1,303	-	-	213
Lighting eff commercial	10,905	3,425	-	-	490
All Commercial	15,038	4,728			703
HVAC government	564	178	-	-	29
Lighting eff Government	1,487	467	-	-	59
ALL Government	2,051	645			88
TOTAL	**575,630**	**85,301**	**51,684**	**5,250**	

The strategy prioritises a number of the demand side interventions for implementation.

Implications for individual municipalities and role of Provincial Government

Many of the interventions explored can be promoted and implemented directly by individual municipalities. Province is thus an important catalyst in the process of driving the process and programme to develop a sustainable energy system as is envisaged in the ***Provincial Sustainable Energy Strategy.***

Facilitating the Development of a Demand Side and Energy Efficiency Programme

Potentially suitable functions that Provincial Government can play in order to develop the DM/EE programme include:

- Information development and dissemination on strategies, financial benefits thereof, and programme implementation.
- Capacity building of local government to enable implementation.
- Facilitating the development of financing mechanisms for solar water heaters, and liaising with national government in this regard.
- Develop CDM or other province-wide projects to secure carbon revenue and lowering of transaction costs.
- Facilitate bulk supply of products where appropriate.
- Support local government with implementation via development of pro-forma by-laws, regulations and guidelines.
- Active promotion of public transport modes, implementation of public transport and modal shift plans, and support to municipalities around implementation of smaller-scale public transport initiatives.

Developing a **Local Government Programme of Action** will ensure that the key targets and initiatives that require the full participation of Local Government are effectively implemented.

Municipal Actions to Implement Demand Side and Energy Efficiency Programmes

The role of municipalities revolves more around implementation, and may include:

- Actively embarking on a sustainable energy path, through developing specific sustainable energy plans and strategies, and soliciting support from Province in this regard.
- Development and dissemination of information specific to the municipality (using resources provided by Province).
- Implementation of efficient lighting in residential, commercial and government sectors.
- Promotion of efficiency in industry.
- Seeking support from Province in the implementation of a Solar Water Heater programme.

The Demand Side and Energy Efficiency programme can make a significant contribution to realising the Province's ***Sustainable Energy Strategy and Programme.*** A summary of the feasibility and challenges of various energy efficiency interventions is tabled below.

Table 5: Viability of Energy Efficiency Measures

	Efficiency Measure	Financial Feasibility	Social Benefit	Environmental Benefits	Implementation Priority	Challenges
Residential	SWH	✓	✓	✓	Immediate	Establishing suitable financing mechanisms may be institutionally demanding. Also, appropriate standards for equipment and operation need to be in place.
	CFL	✓	✓	✓	Immediate	Dissemination of CFLs and information poses a minor challenge.
	Ceilings	×	✓	✓	Medium-Term	Installation costs are prohibitive in the low-income residential sector
Commercial & Government	CFL	✓	-✓	✓	Immediate	Information dissemination poses a minor challenge.
	HVAC efficiency	✓	-✓	✓	Immediate	Information dissemination to ensure behaviour change poses a minor challenge.
Industry	Efficiency	✓	✓	✓	Immediate	Information dissemination to ensure behaviour change poses a minor challenge.
	Industry fuel switch	?	✓	✓	Medium to Long	Distribution infrastructure of natural gas is a large project, but is being addressed nationally.
Transport	Modal shift	?	✓	✓	Immediate Long-Term Duration	Infrastructure and planning demands are significant to realise a significant modal shift. Infrastructure costs are likely to be huge.
	Taxis to diesel	?	✓	✓	Medium to Long	Challenging to realise changes in a poorly regulated industry such as this.
	Bio-diesel fuel switch	?	✓	✓	Medium-Term (Immediately start with promotion strategy)	Inclusion of bio-diesel in the supply network poses an institutional challenge, however the oil companies can undertake this with relative ease.

? = unknown, needs further investigation
✓ = yes
×= no

5 ENERGY SUPPLY IN THE WESTERN CAPE

The Western Cape buys most of its electricity from Eskom, much of which comes from coal generated energy plants elsewhere in the country (predominantly from Mpumalanga). A portion of our electricity is generated locally and sold nationally, including energy from the Koeberg Nuclear Power Plant, the Acacia Gas Turbines, the Palmiet Pumped Storage Facility and the Klipheuwel Demonstration Wind Farm. The City of Cape Town also produces a small amount of electricity through the Steenbras Pumped Storage facility and local gas turbines.

Although Eskom has line strengthening plans in place to help secure electricity for the Western Cape, there are a range of other options that may be preferable, including diversifying the supply mix and broadening the energy generation options.

Petrochemical and Fuel Profile

A large portion of the Province's liquid fuels are imported, though the Caltex refinery in Milnerton supplies a significant portion of refined liquid fuels.

The Provincial Strategic Infrastructure Plan aims to address options for expanding the Province's public transport network. Strategies for introducing cleaner fuels need to be integrated into this plan.

Opportunities for Increasing Supply

There are a number of ways in which the energy supply to the Province could be increased and diversified, ensuring energy security and promoting clean, renewable energy sources.

The various opportunities are outlined in the table below with comments on their viability and sustainability.

Table 6: Energy Supply options for the Western Cape

Energy Source	Potential	Sustainability issues
Coal generated electricity	• High potential. • SA has significant coal reserves and new technologies for clean coal (gasification) are being developed. • Will produce base load. • Line strengthening to Western Cape will be essential.	• Building new generation capacity will see an increase in electricity prices that may not make it financially sustainable unless heavily subsidised. • Fluctuations in commodity prices increase financial risk. • Accompanying CO_2 increase is not desirable in light of South Africa's ratification of the Kyoto Protocol and the National Climate Change Response Strategy. • There are concerns regarding health-related issues in Mpumalanga. • Increased coal usage will also jeopardise the City of Cape Town and other cities' commitments to clean energy targets.
Nuclear energy	• Significant potential. • Costly. • Long development lead times will not see plants on stream in time to meet envisaged shortages in the Western Cape in the short-term.	• Nuclear energy is viewed as controversial yet is seen as cleaner than coal, although not carbon neutral. • No clear, acceptable strategies and options exist for disposal of radioactive waste. • Decommissioning of old Nuclear Power plants is extremely costly. • Heavy subsidisation to industry is necessary. • Public resistance for health and safety concerns may increase times to development. • Can be produced locally, although it will feed into national grid and be used nationally
Natural gas	• High potential if sufficient resources of gas are discovered. • Importing gas is an option if no sufficient domestic sources are available. • Supplies are currently not confirmed.	• Natural gas is a cleaner fossil fuel-based option than coal. • It is less controversial than nuclear energy and can provide base load capacity. • Options for local job creation are high. • Can be generated locally
Wind energy	• High potential (3000 MW approx.) in the Western Cape, but resources need to be confirmed. • Technology & capital costs are reducing rapidly. • Low maintenance. • High job creation potential	• Clean option. • Intermittent supply and storage issues need to be resolved. • Cannot supply base load unless working with hybrid solutions. • Can be quickly installed in areas needing new supply. • Can be generated locally

Energy Source	Potential	Sustainability issues
Biomass	• Medium potential: 1 to 50 GJ/ha/pa. • Insufficient assessment of commercial potential in Western Cape. • Opportunities for small biomass projects particularly within forestry and agricultural industry. • No clear assessment of other biomass potential e.g. sewage wastes.	• Renewable resource. • Job creation in downstream and upstream industries. • Lower emissions if sound technology is used. • Producers obtain their own energy requirements from this source, therefore lessening the demand on the grid.
Solar radiation	• Medium to high potential. • Radiation varies from 6,501- 7 000 MJ/m2/pa across the province. • Solar PV technology is expensive. • High job creation potential – manufacturing, installing, distributing; • Significant potential for SWH projects either at large residential scale or individual level.	• A clean technology from a renewable source • Small business opportunities exist • Few local manufacturers of PV & SWH to meet expected increased demands • Possibility of subsidisation from national bodies • Will be generated locally; does not need a grid connection
Wave power	• High potential. • Significant resources along West Coast particularly Cape Columbine through to the Cape Agulhas area. • Availability of appropriate technology to be assessed. • High capital costs.	• Renewable energy source • No CO_2 emissions but may have high ecological impact. • Job creation potential not quantified but is significant. • Can be generated locally
Waste	• High potential for energy recovery from waste – landfill gas in particular (e.g. 6 sites in Cape Town). • Capital investment high.	• Controversial in the case of incineration of certain wastes. • Landfill gas projects are viable and can benefit from the Clean Development Mechanism (CDM) financing support. • Financial viability marginal but new technology may improve this. • Can be generated locally
Hydropower	• Low potential. • Depending on resource assessments, potential for small-scale stand-alone projects may exist. • These will not be suited for grid connection.	• Renewable resource but impact may be high especially in sensitive aquatic systems. • Financially not viable without significant subsidies or innovative financial engineering. • Can be generated locally

6 PORTFOLIO APPROACH TO ENERGY PLANNING

Traditionally, energy planning has followed a least cost approach which often fails to take into consideration issues of sustainability, social development and environmental protection.

In order to avoid these oversights, the Provincial Sustainable Energy Strategy will adopt a portfolio-based approach which focuses on securing a range of secure energy generation and management options including demand and supply side options.

This approach promotes a range of energy efficiency and conservation measures and the diversification of the energy supply mix, with a focus on sustainable and clean energy sources.
Fossil fuel and energy intensive consumption patterns are entrenched in the energy policies and programmes of many developing countries and South Africa is no exception. Energy planning processes are dominated by a supply-oriented paradigm that links GDP growth directly with energy use.

Cross-country experience has shown, however, that national energy demand is proportional to GDP *if and only if* the structure of the economy and the energy intensities are constant. In addition, a widely-held belief among policy-makers is that the only energy carriers of significance are coal, petroleum-derived liquid fuels, natural gas for industry and transport, and electricity for almost all other services. Linked with this is the often-mistaken idea that the investment costs of harnessing energy from renewable sources would be much higher than from fossil fuels.

Expenditure on increasing energy supply represents a major economic cost to all countries. In the developing world, the financial and opportunity cost of capital, foreign exchange constraints, and the cost of energy subsidies combine to create severe economic constraints to supply-driven models for expanding energy. The present level of worldwide investment in the energy supply sector, $450 billion per year, is projected to increase to perhaps $750 billion per year by 2020, about half of which would be for the power sector. Such investment levels cannot be sustained by traditional sources of energy financing.

Within this context, the Provincial Government has adopted an approach that attempts to address these disparities and which is proving itself in a number of countries. The *portfolio-based approach*[4] to energy planning and development requires that a rapidly developing and vibrant economy that wishes to secure its long term sustainable development returns and hedge itself against unforeseeable future risks (supply short falls, power outages, volatility in fossil fuel prices, rising costs of fossil fuel extraction, carbon taxes, climate change, etc) should invest in a portfolio of secure energy management and generation options. These options include both demand and supply side options, but focus on the development of a number of supply side options that support the move towards ensuring greater share of the energy supply mix comes from clean and/or renewable energy options that run alongside traditional sources of supply.

The energy programme is thus based on a mix of energy efficiency and conservation measures as well as a progressive generation mix that sees the conventional reliance on limited generation options being replaced by a broader portfolio of energy options.

[4] Awerbuch, 2003

7 RENEWABLE ENERGY AND POSSIBLE ACTION

The Proposed Renewable Energy Plan of Action is a fundamental part of the Sustainable Energy Strategy developed for the Western Cape Provincial Government. The plan feeds into the SES and broader Programme of Action and has helped to clarify many of the outstanding questions posed in the SES, most notably around the availability of the resources needed in order to realise the targets and actions proposed in the SES.

Renewable Energy – A viable Alternative

The Plan of Action clearly outlines the viability of a 15% Renewable Energy target by 2014, based on the four scenarios and highlights the challenges that will need to be overcome in order to deliver on this strategy. The plan shows clearly that the resources are available in the Province but highlights the challenges of exploiting these at a level of commercial viability. Provincial Government must work with a range of stakeholders across the Province to ensure that the objectives are achieved.

Renewable Energy Resource Base

The renewable energy resource assessment and scenarios underpin the Plan of Action which clearly out lines the challenges of meeting a 15% Renewable Energy target by 2014, based on the four scenarios developed.
The plan shows clearly that the resources are available in the Province but highlights the challenges of exploiting these at a level of commercial viability. Provincial Government will work with a range of stakeholders across the Province to ensure that the objectives are achieved.

It is the intention of the Department to fast-track the Programme of Action in order to initiate the development of a vibrant renewable and clean energy sector in the Province. The preliminary resource assessments conducted provide an overview of what might be possible in the provincial context. The Renewable Energy Programme of Action forms a backdrop to the renewable energy investment summit aimed at stimulating this sector.

Wind

Wind resources in the Western Cape are substantial – amongst the best in the country. The average wind speed as measured across the Province at 12m is 6m/s.[5] The South African Wind Energy Programme's initial assessments of key areas along the West Coast as well as the interior (Karoo) and the Southern Cape highlight the strong energy potential. Initial assessments show it will be possible to generate 2800MW of wind energy in the Western Cape taking into consideration certain development restrictions.
The region also leads the country in terms of implementation experience, with the establishment of the Darling Wind Farm north of Cape Town. Wind generation, as with most renewable energy and other new power plants, presently cannot compete financially with the current national grid supply given the lack of subsidy that other energy sources have enjoyed. However, wind generation costs are steadily decreasing, and it is expected that national grid electricity prices will rise steadily as new, more expensive generation plants are brought on-line. In addition, private developers continue to find innovative ways of reducing the cost of renewable energy sources.

[5] SA Wind Energy Programme, UNDP,2005; Wind Atlas, DME, 2003.

Wind thus remains one of the most promising renewable generation options in the short to medium term.

Solar PV

Although solar photovoltaic (PV) generation prices have been reducing over the decades, it is still an expensive option for electricity in this country – generally far too expensive to consider as a mass generation option. It remains appropriate for applications isolated from the grid, such as rural clinics or homesteads, and for special projects where users are prepared to pay a premium for solar power. With grid-synchronised solar PV systems now available in the country, there is a steady increase in installations in urban areas, although they will only provide a tiny contribution to the overall energy mix into the medium-term. While solar radiation levels in the province are reasonably high, they are not the highest in the country. Although large-scale generation plant are being considered by government, they are likely to be located elsewhere in the country for this reason.

Solar water heaters

Solar water heaters are an established technology, and are financially and technically appropriate for mass installation. To date they have not been adopted widely because of lack of national government support and inadequate financing arrangements which result in installations being unaffordable to most households. Prices of units are steadily reducing, partly because of products from the east becoming increasingly available in the country (the new, more efficient 'vacuum tube' technology). Solar water heaters are one of the most promising renewable resources in the short-term, and implementation of mass schemes is relatively simple provided supporting facilities, such as suitable financing and maintenance operations, are in place.

Bio-diesel

Bio-diesel has numerous advantages over conventional diesel. It is carbon-neutral, can easily be locally produced, creates significant jobs in all aspects of the production chain, and can easily be adopted by most diesel vehicles without modification. It may also be cost-competitive with current oil-based diesel. National government has started promoting bio-diesel, and it may become a significant part of the national supply mix in the medium-term. There may be suitable land for a variety of feed stocks to be grown in the Western Cape – land which is too marginal for conventional crops. However, the production of bio-diesel on a mass scale may run into feedstock constraints, depending on the land available for feedstock cultivation. New technologies such as flash pyrolysis are being investigated by industry players. The detailed scenarios on the bio-diesel challenges can be found in the separate appendix to the Renewable Energy Scenarios document.

Other biomass

There may be scope for electricity or heat generation from biomass waste from sawmills, or from pulp plants, in some specific locations within the province. Cost competitiveness and energy quantities are not known. Investigations indicate that electricity generation from landfill methane gas sites is feasible, largely because of the carbon revenue available for methane emissions reduction. This opportunity is being exploited in the country's biggest landfills, and could be available for smaller sites in the future.

Hydro

There are likely to be several sites where small scale hydro is feasible – mainly in the mountains of the wetter regions of the Province. Large seasonal variations in water flow can be a problem with this energy source. The generation potential of this resource is not known, although it is considered unlikely to be a significant contributor to the energy mix. Its application is expected to be mainly for sites remote from the grid. The DME resource maps for small scale hydro are used as a basis for assessment. The department will continue to explore this generation option.

Pumped storage

Pumped storage is not a source on net generation, but rather a means of smoothing out load peaks. It is typically around 70% efficient – comparing input pumping energy to generated energy. Eskom has a large pumped-storage site in the Province, at Palmiet, which it uses to regulate peaks on the national grid, and the City of Cape Town has a smaller site at the Steenbras Dam for its own use. Little attention is given to pumped storage as an option within the Province.

Wave energy

Wave energy development is still in its infancy but holds much promise as a source of bulk renewable energy. Whilst the Western Cape is blessed with a long coastline and preliminary results show that the wave resource is substantial, no large scale commercial projects are yet in place. The department will continue to encourage private developers to explore options for large scale generation of the Cape coastline considering the potential environmental impacts that this technology may have on marine ecosystems.

Scenarios

The strategy focuses on the period up to 2015 although much of the scenario development takes the programme through to 2035. The six scenarios that were developed in order to assess the viability of the proposed targets provide role players with a clear idea of the enormity of the challenge facing the Province. These six scenarios are highlighted below:

Table 7: Renewable Energy Scenarios

Short name	Longer description	Comments
BARD BAU Ref Demand	Business as usual, reference demand	Continued reliance on fossil fuels, demand growth as per demand study reference case
BAEC: BAU Energy Cons	Business as usual, energy conscious demand	Continued reliance on fossil fuels, demand growth as per *energy conscious* scenario discussed
PRRD: Prog Ren Ref Dem	Progressive Renewable, reference demand	Progressive renewable energy planning, demand growth as per *reference* scenario
PREC: Prog Ren Energy Cons	Progressive Renewable, energy conscious demand	Progressive renewable energy planning, demand growth as per *energy conscious* scenario
HRRD: High Ren Ref Dem	High Renewable, reference demand	High promotion of renewable energy, demand growth as per *reference* scenario
HREC: High Ren Eng Cons	High Renewable, energy conscious demand	High promotion of renewable energy, demand growth as per *energy conscious* scenario

To reach a target of 15% by 2014 the Province will need to focus on implementing a Plan of Action based on the 'High Renewables, Energy Conscious Demand'.

Delivering on job creation

The progressive renewable energy, energy conscious scenario (PREC) indicates a net job benefit of 16 000 by 2014 and 75 000 by 2035 over the business as usual scenario. The High Renewable scenario would obviously show an even greater number of new jobs created. This provides Provincial Government with sufficient evidence that a renewable energy industry is desirable and will deliver economic and financial benefits to various stakeholders, over and above the environmental and social benefits of the plan.

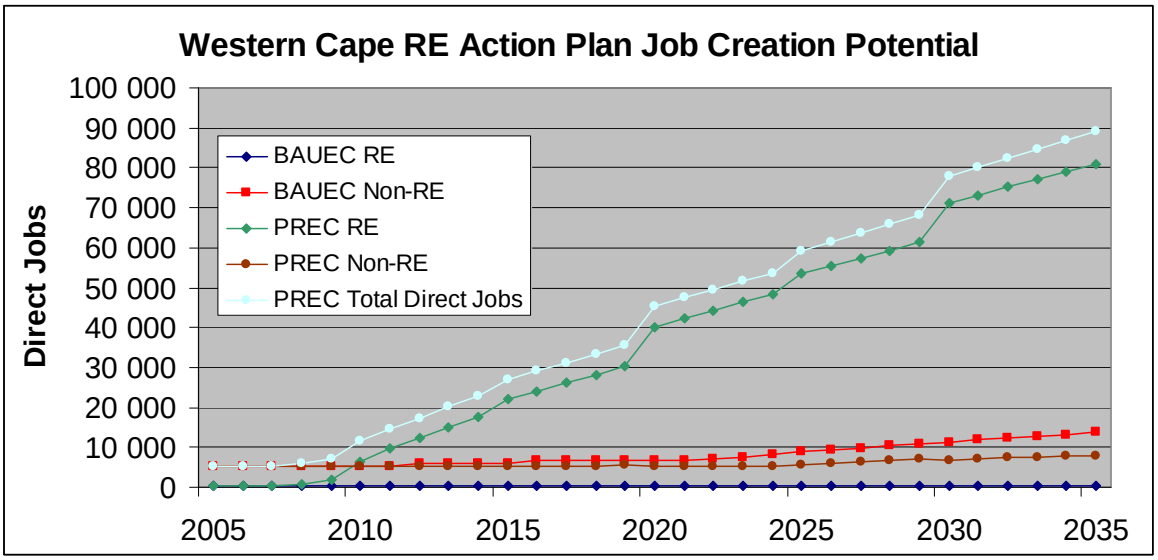

Figure 44: Job creation potential

Delivering on industry development potential

The required investment in renewable energy technologies is in the region of R 8, 8 billion by 2014, R12 billion by 2015 and R26 billion by 2020. Although this represents a significant capital outflow, it also results in significant regional industry development, and high levels of permanent job creation. The capital needed will also hopefully stimulate investment into projects in the Province. Given the significant interest by various players (private sector, state institutions, and local authorities) in developing energy projects, Province will aim to support these players in realising the benefits associated with the industry development.

Delivering on CO_2 emissions reductions

One of the main reasons for promoting a strongly renewable energy component for the Western Cape energy consumption is to reduce the greenhouse gas emissions from the use of electricity.

If the energy supply mix were to remain similar to current, and demand were to grow inline with the reference demand curve – by 2035 the Western Cape electricity sector would be responsible for more than double the current CO_2 equivalent emissions. The graph clearly shows the significant impact of energy efficiency measures, with the BAU Energy Conscious Demand Curve

reducing final emissions from just over 34 million tonnes to about 22 million tonnes (but still leaving emissions higher than they are in 2007).

The only scenarios which show a net reduction in emissions are the *progressive renewable energy conscious* scenario, and the *high renewable energy conscious scenario.* The *progressive renewable energy conscious* in particular shows the power of energy efficiency combined with active support of renewable energy to achieve mitigation objectives.

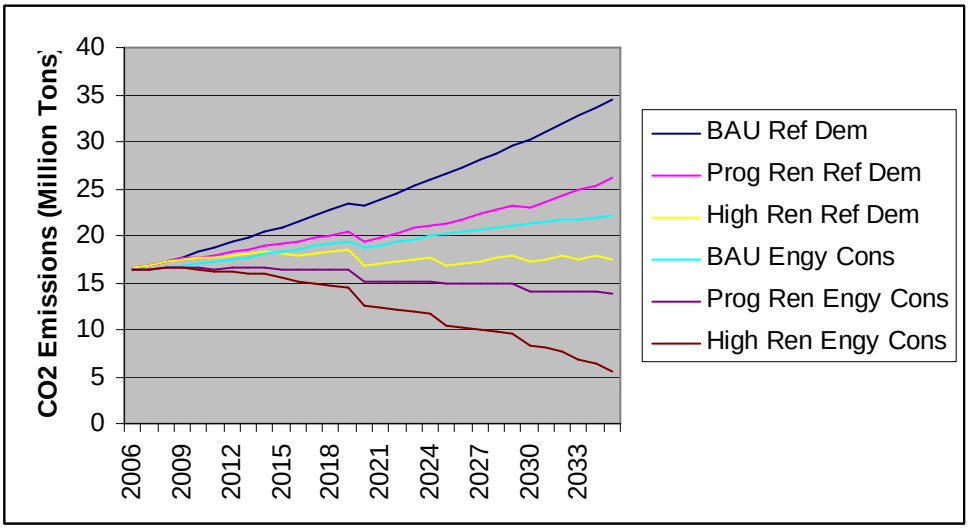

Figure 45: Western Cape potential emission reductions

Delivering on the overall objectives

Based on the assessment of renewable energy resources, conversion technologies, growth in demand and presented in the above scenarios, the following conclusions can be drawn:

- Energy efficiency is clearly shown as a critical tool to reducing CO_2 emissions;
- There is significant potential in the medium to long term to generate a high proportion of electricity needs from renewable resources, and *based on the cost change assumptions used in the plan,* the cost differential compared to a business as usual scenario is reasonable;.
- 12% *locally* generated renewable electricity by 2015 is just achievable (as per the scenarios investigated) if a highly aggressive renewable energy plan is implemented and strong energy efficiency is practiced – the High Renewable Energy Conscious scenario;
- There is some scope to import renewable generated electricity from other regions. However, by 2015, this amount available may not be sufficient to achieve a 15% target, thus requiring the Province to ensure that an aggressive local target is pursued.
- The *progressive renewable* and *high renewable* scenarios (coupled with *energy conscious demand*) illustrate the possible contributions that could be achieved (based on the models developed).

From an electricity perspective, the scenarios and plan show an encouraging picture in the longer term, as the resources are available to generate a high proportion of electricity from Renewable (and in time to even export renewable energy). Furthermore, it is clear that the Province could keep CO_2 emissions from electricity consumption at current levels (using for example the

progressive renewable energy conscious scenario), while still maintaining electricity prices within reasonable limits.

Proposed Provincial Energy Targets

The scenarios indicate an evolution in the energy sector. These scenarios are translated into a set of objectives or targets for the province.

In some cases there is uncertainty associated with the targets, and revision/updates will be necessary over time as more detailed experience and research emerges. However, bold leadership and aggressive plans are needed if the Province is to achieve sustainability.

Table 8: Renewable Energy Targets

Number	Target	Comment
RE 1	12% of the electricity consumed in the Western Cape will be from certified local renewable energy generation resources by 2014, 18% by 2020, 30% by 2030. This means the remainder, to reach 15%, will need to come from sources outside of the province initially)	These are slightly higher than the *Progressive Renewable Energy Conscious* Scenario, but less than the *High Renewable Energy Conscious Scenario*. Assumes significant growth of the renewable energy generation *as well as* significant energy efficiency endeavours.
RE 2	Institutions with the Western Cape Government Structures (as well as local authority governments) will ensure that 15% of the electricity they use is generated from renewable energy resources by 2014	Although this is a relatively small amount of electricity, it will help to kick start activities in the sector and provide certainty for early stage investors
RE 3	Solar Water Heaters be installed at a rate compatible with the scenario presented in the Demand Side and Energy Efficiency Strategy.	The Provincial Government will need to work with major Metro's and towns to launch a SWH programme.
RE 4	Biofuel should be incorporated within the provincial diesel and petrol consumption, in line with Nationally agreed strategy. Provincial Government fleet to lead the conversion and uptake of biofuel with 50% of the fleet converted by 2010.	Although many may wish to propose a higher target than the National Target, caution is urged until more experience of this complex sector has been obtained.
RE 5	Industry, electricity distributors and other key purchasers of electricity undertake to source a portion (15%) of their electricity from renewable resources, so as to individually achieve the targets set out in RE 1. This type of voluntary undertaking is consistent with recommendations of the national TREC system feasibility study.	This is not a mandatory target. However, provincial government will investigate the option of introducing an environmental tax linked to the energy input mix of industries in the province. Provincial Government will work with key stakeholders to develop a Provincial Energy Charter. Provincial government will lobby municipalities to introduce a component of renewable electricity within their mix and establish generation projects.
RE 6	New buildings include on site generation for 10% of their energy needs.	Should be aligned with the building guidelines developed by D: EA&DP which need to be implemented and regulations developed.

RE 7	CO_2 equivalent emissions attributable to the consumption of electricity should be held within 5% of 2006 levels, and by 2020 there should be a downward trend.	This can be achieved if actions similar to the Progressive Renewable Energy Conscious scenario are followed

Achieving the targets required to mitigate CO_2 emissions and to allow economic growth, improve energy efficiency and simply maintain power security is an enormous challenge. If renewable energy is to play the role envisaged in the progressive or high renewable scenarios proposed in this plan, then very significant changes in scale of the industry and financial flows are required. Provincial Government will ensure these objectives are realised through an aggressive Plan of Action.

Furthermore, these are industries where the human and technical capacity required per unit of capital investment (or per MW installed) is larger than for equivalent large scale fossil plants. It is thus necessary to specifically look at strategies to rapidly develop and upscale new industries (such as the envisaged industry focus groups proposed by the Department of Economic Development), human resources, project development and approval processes, as well as financial flows. This plan provides some indications of what is needed. However, significantly more planning, research and strategy development is needed in order to put in place a concrete plan for expansion of the renewable energy contribution.

Plan of Action

The Renewable Plan of Action as well as the broader Action Plan will require co-ordination and collaboration across a number of government departments as well as with various external stakeholders.

Table 9: Renewable component of the Plan of Action

Number	Area	Action	Inception date	Impact
REA 1	Establish mechanism for Renewable Energy accounting in the province.	Support national development of a TREC's or similar system that can allow for clear accounting of renewable energy consumed in the province.	2007	Necessary input to market creation, and for implementation of renewable energy obligations
REA 2	Stimulating renewable electricity production.	Support establishment of either feed-in tariffs, renewable energy obligations, or similar for key consumer classes.	2007	Create viable market for electricity generated from renewable resources
REA 3	Stimulating renewable electricity production	Research option to introduce environmental tax or certificate buy-back level on all entities over a certain size that does not meet provincial renewable energy targets. Ring fencing would provide a fund for direct support of projects.	2008	Create viable market for electricity generated from renewable resources
REA 4	Western Cape Government and	Purchase TREC's or equivalent certified renewable electricity or	2008	Create minimum secure market for

	local authorities to lead by example and purchase renewable electricity.	establish own generation projects.		renewable electricity
REA 5	Renewable Electricity Generation Facilitation.	Support research efforts that provide pre-feasibility grade information on resource/transmission capability/opportunities	2008	Helps RE investors overcome preliminary project identification hurdles
REA 6	Renewable Electricity Generation Facilitation.	Ensure that EIA processes are conducted efficiently.	2008	Critical to rapid project development
REA 7	Renewable Electricity Generation Facilitation.	Assist with power purchase negotiations	2007/2008	Critical to financial closure on projects
REA 8	Renewable Electricity Generation Facilitation.	Transmission line monitoring, enhancement, grid code development and network modelling.	2010	Government needs to ensure that infrastructure is planned/in place to transmit power as needed
REA 9	Renewable Electricity Generation Facilitation	Carefully targeted subsidies/financial assistance for feasibility studies.	2009	
REA 10	Renewable Electricity Generation Facilitation	Grid connection codes, finalized, made easily available, applicable.	2008	These are significant barrier to small scale distributed generation (e.g. PV grid connect)
REA 11	Promotion of cleaner Fuels	Facilitate introduction of biodiesel and ethanol production and consumption in the Province.	2007	
REA 12	Promotion of cleaner Fuels	Research support for biofuel feedstock development, as well as biofuel socio-economic impact assessment.	2007/8	
REA 13	Industry development	Incubator company support.	2008	
REA 14	Industry Development	R&D support (financial, capacity development, also assist in making public sector funded research outputs available to public.	2008	Stimulate much needed R&D. Ensure that R&D that has been done using public money is available for use.
REA 15	On site generation target	Investigate setting a 10% on-site renewable energy generation obligation for all new buildings over a certain size.	2009	This has significant economic implications which need to be properly investigated, but it could have important

				impacts. The city SWH by-law could provide guidance in this regard.

Supporting Renewable Energy – removing barriers to entry

Regulatory reform and initiatives aimed at opening up the energy sector to Independent Power Producers is a stated objective in the National Government's Energy Bill. Provincial Government will support this approach as it falls in line with the energy planning philosophy adopted in the energy strategy, namely developing a portfolio approach to energy planning.

To encourage the development of an energy sector where renewable energy and energy efficiency are regarded as crucial elements of the development strategy, these barriers will need to be addressed. The energy strategy and programme addresses, but does not aim to replace the mandatory work of National Government.

The Provincial Department's role will primarily be supportive and enabling and where necessary, they will spearhead key projects alongside other government and non-government partners.

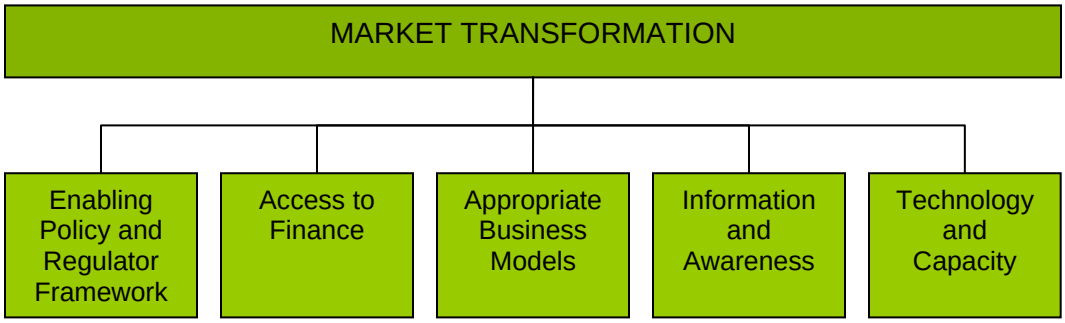

Figure 46: Barriers to Market Transformation (Eberhard, 2005)

Each of the barriers will be addressed by securing the involvement of key stakeholders who will be able to provide the resources and capabilities to remove these barriers.

8 INTEGRATION

Multi-Stakeholder Integration

The Provincial Government is adopting a facilitation and co-ordination role regarding renewable energy and energy efficiency in the Western Cape. The PGWC will work closely with National and Local Government, as well as with civil society to ensure that the sustainable energy strategy complements energy work being done at various levels, and to ensure that implementation occurs as envisaged.

The Provincial Government will ensure that the Western Cape Sustainable Energy programme complements the policies and strategies of **National Government**. National Government will also be lobbied to for financial support for energy projects in the Province.

Local Government plays a crucial role in energy planning and delivery. To support Local Government, the Provincial Government will inter alia, conduct energy audits at local level, provide support for incorporating energy concerns into Local Economic Development plans, offer capacity building support and improve communication and planning between government spheres and components.

The Provincial Government will work closely with **Wesgro**. Wesgro has played a key role in championing the establishment of an oil and gas hub in Saldanha, and has helped facilitate the introduction of international energy companies to the Western Cape. Wesgro will continue to be a valuable sector development partner.

Civil society also has a key role to play, and the Provincial Government will involve the **Provincial Development Council** (PDC) in energy planning and will ensure that the PDC is regularly updated on progress through quarterly updates.

Cross-Sector Integration

Energy concerns are not isolated to a single sector or government department – energy supports all aspects of industry, commerce, residential, healthcare, social development, economic development, transport and so forth. Renewable energy principles and strategies need to be incorporated into the strategies affecting all these areas.

It is essential that the Provincial Government's approach to energy planning is integrated into the following key strategies and plans which can be found at www.capegateway.gov.za:

- Spatial Development Framework
- Strategic Infrastructure Plan
- Micro-economic Development Strategy
- Local Economic Development Strategies

Provincial Sustainable Energy Action Team (SEAT)

To help ensure that all stakeholders are actively involved in the sustainable energy programme, the PGWC will create a Provincial Sustainable Energy Action Team (SEAT), which will consist of representatives from all the relevant government and other stakeholder groups. The SEAT will meet every 4 months and a chairperson of high standing from outside the Provincial Government will be sought out.

9 STRATEGY FRAMEWORK AND PROGRAMME OF ACTION

The strategy comprises a number of elements. Each of these is key to shaping the overall programme that has been developed and is highlighted in the diagrams below.

The **Key Principles** on which the success of the Sustainable Energy Strategy (SES) is based are listed below. These are crucial in ensuring that an enabling environment is created that will allow

the Government to achieve the goals and objectives set out. They are pre-conditions to the success of the overall programme:

- Demonstrating leadership through action;
- Building effective partnerships;
- Stimulating the market for renewable energy and energy efficiency;
- Implementing appropriate financial mechanisms to support market development, and;
- Supporting Local Government.

The **Energy Vision and Strategic Intent** is described in the diagram below.

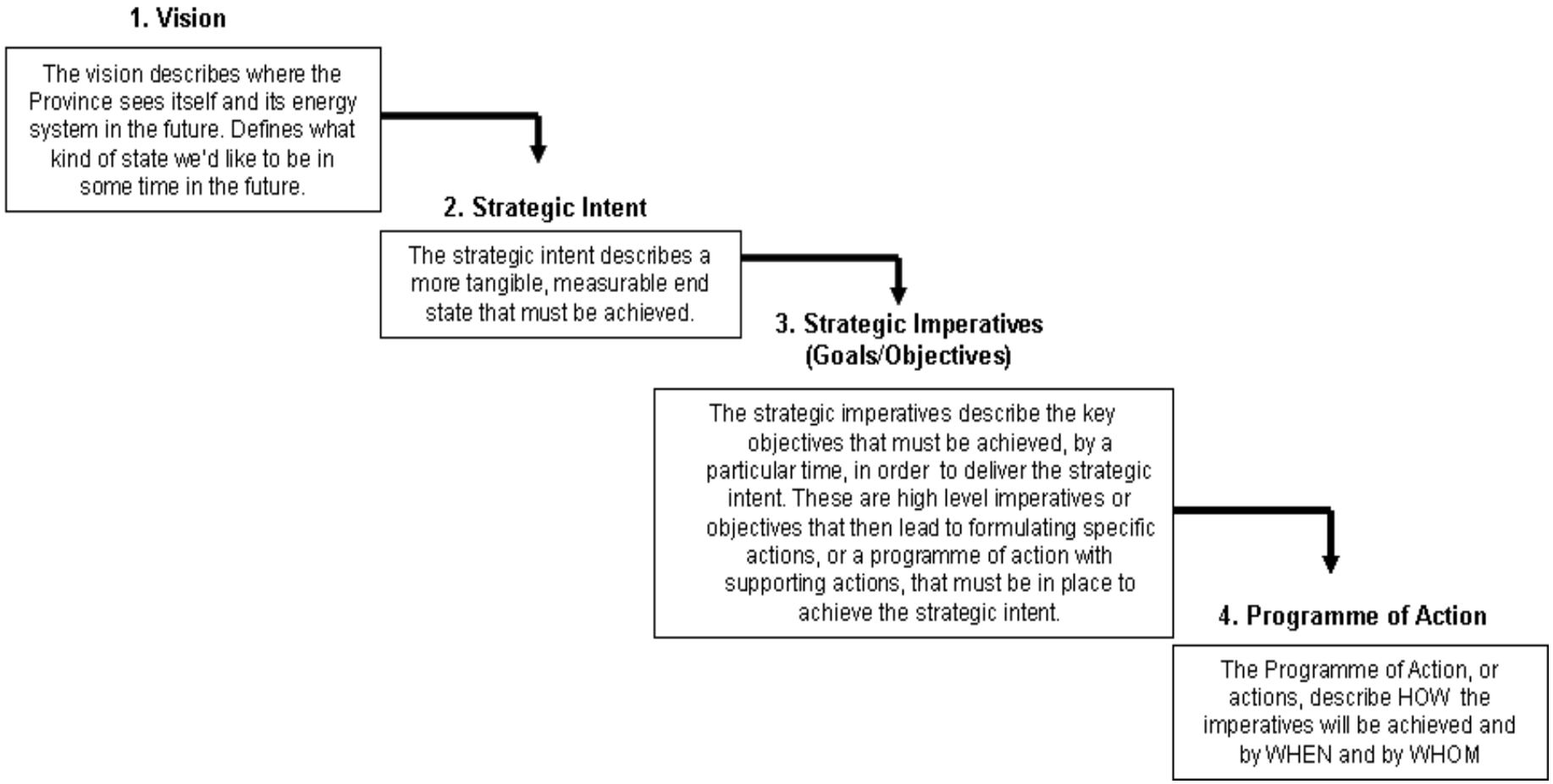

Figure 47: Strategy development framework

Energy Vision	To ensure that the Western Cape has a secure supply of quality, reliable, clean energy, which delivers social, economic and environmental benefits to the Province's citizens, while also addressing the climate change challenges facing the region and eradicating energy poverty.
Strategic Intent	To develop a sustainable energy system that reduces its impact on people's health and the environment whilst contributing to long term sustainable economic development (PGDS, SDIP).

Figure 48: Vision and strategic intent

In order to deliver on the SES (i.e. to achieve the vision, reduce the dependency on fossil fuels, as well as to achieve the targets and goals for energy efficiency, renewable energy generation and carbon reduction) the PGWC has to create an enabling environment that will allow for these objectives to be reached. The creation of this enabling environment forms the basis of the Department's **Programme of Action**.

By leading by example, the PGWC will demonstrate its commitment to the energy strategy and demonstrate the viability and effectiveness of some of the interventions. Working with all stakeholders will make implementation possible on a wider scale. Providing both incentives and disincentives will help direct behaviour toward more energy efficient and sustainable practices.

The **Strategic Imperatives** or high level objectives are described in the table below. These form the basis of the Programme of Action that is laid out in the tables on the following pages. The Programme of Action describes a number of activities and programmes that have already been initiated by various entities as well as those that the PGWC intends to develop depending on feedback from stakeholder groups and its social partners.

Strategic Imperatives	1. to improve the health, welfare and prosperity of all citizens in the Province; 2. to reduce the Province's contribution to climate change by reducing CO2 emissions from all sectors primarily through energy efficiency, renewable energy and cleaner fuels; 3. to reduce, and where possible eliminate, pollution from a variety of sources especially vehicular emissions; 4. to promote the development of sustainable energy technologies and projects and enhance energy efficiency; 5. to eradicate fuel poverty and provide access to modern energy services; 6. to provide energy security through diversifying the energy mix; and 7. to contribute to greater economic development, economic competitiveness and job creation though delivering sustainable energy and improving the performance of our building and housing programmes.

Figure 49: Strategic Imperatives

The strategic imperatives or high level goals will be achieved by implementing the specific objectives highlighted in the tables on the following pages.

Consolidated Targets and Action Programmes

Proposed Energy Targets for the Western Cape

ACTION	TARGET	DATE
1. Renewable energy generation (electricity only) in the Western Cape off the current consumption baseline of 4200MW	15%	by 2014
2. Overall energy efficiency against business as usual scenario	15%	by 2014
• Industry energy efficiency	20%	by 2014
• Residential energy efficiency	10%	by 2014
• Commercial energy efficiency	11%	by 2014
• Transport energy efficiency	12%	by 2014
• Government	12%	by 2014
3. Overall energy efficiency against business as usual scenario	15%	by 2020
4. Carbon dioxide emissions reduction (in 2000 levels)	14%	by 2014
5. Carbon dioxide emissions reduction (in 2000 levels)	15%	by 2020
6. Renewable Energy purchased by Provincial Government	10%	by 2010

Table 10: Goals and Associated Actions

STRATEGIC OBJECTIVE 1: LEADERSHIP THROUGH ACTION				
Objective	**Output**	**Action**	**Who – Partners / stakeholders**	**Initiation Date**
Co-ordinate and provide leadership	Clear Mandate and Institutional Mechanism	Develop a legislative framework and Provincial Sustainable Energy Action Team (SEAT).	Dept of Environment Affairs & Development Planning (D:EA&DP) Department of the Premier, D:EA&T	May 2008
	Energy Efficiency Map	Track the implementation of energy saving and efficiency programmes across the province, in conjunction with local authorities.	D:EA&DP and continued by Independent Body/SEAT, local government, Eskom	May 2007
	Provincial Energy Budget	Investigate mechanisms for expanding the provincial discretionary budget to fund clean energy programmes to complement the Department of Minerals and Energy's renewable energy subsidy programme and future feed-in tariffs.	Provincial Treasury	May 2008
	Energy Policy and Strategy Integration	Integrate energy efficiency and renewable energy principles and objectives into the relevant Provincial planning frameworks (SDIP, PSDF, MEDS, LEDS).	D:EA&DP Office of the Premier	May 2007
Ensure that the technology and capacity exists in the Province to implement the projects	Local Authority Support	Support municipalities to undertake city energy strategies and set sustainable energy goals and implement on projects. Support capacity building programmes with local authorities, in conjunction with the National Energy Efficiency Agency. Energy audits will also be conducted at local level.	Dept of Housing & Local Government (D:H&LG), D:EA&DP, local government	June 2008
	Capacity Building and Industry Development	Assisting industry, NGOs and other stakeholders to develop capacity to deliver by identifying needs in the Province working in conjunction with the various stakeholders. Work with tertiary institutions in developing capacity within the Province.	Department of Economic Affairs & Tourism (D:EAT) and D:EA&DP, NGOs, industry, Local Government	Sept 2008

STRATEGIC OBJECTIVE 2: BUILDING EFFECTIVE PARTNERSHIPS				
Objective	**Output**	**Action**	**Who – Partners / stakeholders**	**Initiation Date**
Enlist support of key Provincial governmental partners	Intergovernmental Energy Task Team established	Implement the second phase of inter-departmental consultations and discussion forums to take forward energy issues developed during initial consultation phase.	D:EA&DP	March 2007
Ensure energy strategy is integrated as a core cluster of the SDIP	SDIP	Establish an energy cluster in the SDIP work stream and conduct briefings with other SDIP clusters and run cluster workshops.	SDIP work stream partners	March 2007
Secure support of national government departments	Endorsement of the energy strategy and participation in various programmes	Conduct briefings with individual ministries and departments and include nominated representatives on the Provincial sustainable energy action team.	SEAT D:EA&DP	July 2007
Secure support and participation of various sector partners	WC Energy charter	• Identify sectoral groupings e.g. learning institutions, business groupings, trade groupings, energy companies, NGOs and community groupings, Trade Unions. • Conduct workshops/briefings with key groupings. Formalize signed off action plans with each sector. • Establish monitoring and regular review mechanisms with each sector body and grouping.	D:EA&DP	August 2007

STRATEGIC OBJECTIVE 3: STIMULATING THE MARKET FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY				
FOCAL POINT: TRANSPORT				
Objective	**Output**	**Action**	**Who – Partners / stakeholders**	**Initiation Date**
Reduce fuel consumption and carbon dioxide emissions from the transport sector through modal shift and fuel switching	Cleaner Fuels Programme	• Convert 10% of the Government vehicle fleet to cleaner fuels • Biofuel should be incorporated within the provincial diesel and petrol consumption, in line with Nationally agreed strategy (RE4)	D:T&PW	October 2007
		• Monitor the health impacts of the national and provincial clean fuels programme (shift to unleaded fuel and introduction of low sulphur diesel)	D:H&LG	June 2008
	Promotion of cleaner fuels (REA12)	• Facilitate introduction of biodiesel and ethanol production and consumption in the province (REA11). • Research support for biofuel feedstock development, as well as biofuel socio-economic impact assessment (REA12).	Department of Transport & Public Works (D:T&PW)	June 2008
	Subsidised Car Schemes	• Revise the tender requirements for the subsidised car scheme to include zero emissions or hybrid vehicles.	D:EA&DP	June 2008
FOCAL POINT: BUILDINGS				
Objective	**Output**	Action	**Who – Partners / stakeholders**	**Initiation Date**
Reduce energy consumption and carbon dioxide emissions from buildings in the commercial and	Energy Audit and Retrofit Programme	• Conduct an Energy Audit of all provincial government buildings.	D:T&PW	Dec 2007
		• Retrofit the Provincial Parliament Complex in Cape Town for energy efficiency (including solar water heating and energy from a photo-voltaic system).	D:EA&DP	Sept 2008

government sectors through energy efficiency behavioural changes, and building retrofitting.	Incentive Programme for Energy Efficiency	• Initiate a study into incentives around energy efficiency together with the City of Cape Town and the Provincial Treasury. • Support establishment of either feed-in tariffs, renewable energy obligations, or similar for key consumer classes (REA2).	D:EA&DP CCT Provincial Treasury	June 2007
	PGWC Pilot Solar Programme	• Implement pilot solar hot water heater programme with local government partner.	D:EA&DP Provincial Treasury	June 2007
Ensure that new buildings in the commercial and government sectors are energy efficient	Develop & Implement Green Design Programme	• Work with industry partners to develop guidelines for energy efficient design.	D:EA&DP	April 2007
		• Develop the new Provincial Government Complex in George according to green design principles.	DT&PW	October 2007
		• Develop the new hospital in Khayelitsha according to green design principles.	DT&PW	June 2007
		• Work with developers to showcase five energy efficient developments in the Province. • Investigate setting a 10% on-site renewable energy generation obligation for all new buildings over a certain size (REA15).	D:EA&DP	October 2007
	Green Procurement Policy	• Adopt a green procurement policy based on the recommendations of the Waste Management Directorate of the D:EA&DP.	Provincial Treasury D:EA&DP	November 2007

FOCAL POINT: CLEAN ENERGY SUPPLY				
Objective	**Output**	**Action**	**Who – Partners / stakeholders**	**Initiation Date**
Stimulate demand for renewable energy, and reduce carbon dioxide emissions from general energy consumption	Clean Energy Supply Programme	• 12% of the electricity consumed in the Western Cape will be from certified renewable energy resources by 2014, 18% by 2020, 30% by 2030 (RE1). • Institutions with the Western Cape Government Structures (as well as Local Governments) will ensure that 15% of the electricity they use is generated from renewable energy resources by 2014 (RE3). • Industry, electricity distributors and other key purchasers of electricity undertake to source a portion of their electricity from renewable resources, so as to individually achieve the targets set out in RE 1. This type of voluntary undertaking is consistent with recommendations of the national TREC system feasibility study (RE5). • Purchase TREC's or equivalent certified renewable electricity or establish own generation projects (REA4). • Ensure that EIA processes are conducted efficiently and that blanket concerns about sensitive areas to not inhibit relatively benign projects (REA6).	Treasury D:EA&DP	March 2007

	Energy Investment & Industry Development Programme	• Work with Wesgro to develop an energy investment programme for the province. • Assist with power purchase negotiations (REA7). • Transmission line monitoring, enhancement, and network modelling (REA 8). • Incubator company support (REA13). • R&D support (financial, capacity development, also assist in making public sector funded research outputs available to public (REA14).	Provincial Treasury WESGRO	August 2007
Support research, development and roll-out of clean energy sources	Renewable Energy Development Programme and investment case	• Work with industry associations to assist in the development and refinement of information to support business model development. • Support research efforts that provide pre-feasibility grade information on resource/transmission capability/opportunities (REA5). • Carefully targeted subsidies/financial assistance for feasibility studies (REA9). • Grid connect codes finalized, made easily available and applicable (REA10).	D:EA&DP Various industry associations and NGO partners	July 2007
	'Solar Challenge' Programme	• Use this mechanism to introduce solar photovoltaic systems and accompanying financial incentives and financing options. • Solar Water Heaters be installed at a rate compatible with the scenario presented in the Demand Side and Energy Efficiency Strategy.	D:EA&DP Provincial Treasury NERSA/CEF	Oct 2007
	Energy Resource Assessments Assessment	• Further clarify the feasibility of renewable energy options in the Western Cape through a wind energy resource assessment conducted in conjunction with industry sector organisations.	D:EADP SESSA/SAWEA/industry groups	March 2008

	Finance Mechanisms and Incentives	• Create a framework for financing renewable energy and energy efficiency projects in conjunction with the Provincial Treasury, the Department of Minerals and Energy and the Central Energy Fund.	Provincial Treasury DME Central Energy Fund	August 2007
Ensure the feasibility of developing a clean energy portfolio in the Western Cape	Generation Study	• Quantify the costs of developing a clean energy portfolio.	D:EA&DP Provincial Treasury	April 2007
FOCAL POINT: RESIDENTIAL ENERGY EFFICIENCY				
Objective	**Output**	**Action**	**Who – Partners / stakeholders**	**Initiation Date**
Reduce the energy consumption and carbon dioxide emissions from the residential sector and reduce health and safety dangers associated with current fuel types.	Domestic Energy Use Programme	• Introduce safer fuels to informal, semi-formal and low-income households. • Build capacity in local CBO's and SMME's to help undertake these initiatives.	D:EA&DP DLG&H DoH City of Cape Town CBO's, SMME's	September 2008
	Safer Energy Plan	• Introduce a province-wide plan to introduce LPG, gel fuel or other forms of energy in mass housing development to replace paraffin. • Build capacity in local CBO's and SMME's to help undertake these initiatives.	D:EA&DP DLG&H DoH City of Cape Town CBO's, SMME's	June 2008
	Solar Water Heating by-laws	• Work with key local governments to introduce solar water heating by-laws.	D:EA&DP City of Cape Town NEEA	June 2008
	Housing Developments energy design programme	• Ensure that energy efficiency and green design principles are incorporated into planning approval processes at local government levels • New buildings include on site generation of 10% of their energy needs, and aligned with the building guidelines developed by D:EA&DP (RE6). • Build capacity in local CBO's and SMME's to help undertake these initiatives.	D:EA&DP DLG&H CBO's, SMME's	March 2008

	Integration into Strategic Human Settlements Programme	• Develop guidelines and practices for energy efficiency and green design for all new large human scale settlements. • Build capacity in local CBO's and SMME's to help undertake these initiatives.	D:LG&H CBO's, SMME's	October 2007
	Health Studies Review	• Monitor the health conditions and safety improvements resulting from the switch to cleaner domestic fuels.	DoH	January 2008
Raise awareness and educate the public around energy efficiency, climate change and renewable energy	Energy Awareness Programme	• In conjunction with the Department of Education and Eskom, undertake a province-wide education and awareness programme.	D:EA&DP DoE Eskom	November 2007
		• Include energy awareness as part of schools' curricula, in conjunction with the national Department of Education.	DoE	January 2008
FOCAL POINT: CLIMATE CHANGE				
Objective	**Output**	**Action**	**Who – Partners / stakeholders**	**Initiation Date**
Initiate efforts to reduce the Province's Carbon footprint	Carbon Tax	• Investigate developing a province-wide carbon tax in line with the national environmental fiscal reform processes.	Provincial Treasury	May 2008
	Climate Change Assessment	• CO2 equivalent emissions attributable to the consumption of electricity should be held within 5% of 2006 levels, and by 2020 there should be a downward trend (RE7).	D:EA&DP	November 2007

STRATEGIC OBJECTIVE 4: IMPLEMENTING EFFECTIVE FINANCIAL MECHANISMS				
Objective	**Output**	**Action**	**Who – Partners / stakeholders**	**Initiation Date**
Develop an internal funding plan to support the roll-out of key aspects of the strategy	Energy Funding plan	• Cost the strategy and develop a medium-term budget. • Develop a finance plan to support government's targeted purchase of 15% of its electricity from renewable sources by 2014.	D:EA&DP in collaboration with AMEU, Provincial Treasury	June 2007
Implement a framework for longer term financial support for provincial government energy projects	Energy financing programme and objectives	• Conduct an assessment of key departmental/ provincial projects and determine funding needs. • Develop guidelines for applications for support. Develop a financing plan along with incentive options in conjunction with the Provincial Treasury. • Research option to introduce environmental tax or certificate buy-back level on all entities over a certain size that do not meet provincial renewable energy targets. Ring fencing would provide a fund for direct support of projects (REA 3).	D:EA&DP Provincial Treasury	August 2007
Establish benefits case for decentralised energy strategy	Establish mechanism for Renewable Energy accounting in the province (REA1)	• Support national development of a TREC's or similar system that can allow for clear accounting of renewable energy consumed in the province (REA1).	D:EA&DP Provincial Treasury and external advisors	September 2007
Establish energy efficiency and renewable energy funding programme	Comprehensive energy funding plan	• Assemble a team of local and international energy finance experts. • Conduct consultative workshops. • Formulate a funding and financing plan.	D:EA&DP DME Provincial Treasury Development Finance Institutions	September 2007

STRATEGIC OBJECTIVE 5: SUPPORTING LOCAL GOVERNMENT				
Objective	**Output**	**Action**	**Who – Partners / stakeholders**	**Initiation Date**
Establish energy forum with Local Government participation	Energy Forum	• Initiate discussions with Local Government and AMEU in order to establish a forum. Participate in AMEU and other Local Government initiatives.	D:EA&DP in collaboration with AMEU, Provincial Treasury	June 2007
Develop joint programme with city of Cape Town to establish energy agency	Energy Agency	• Conduct an assessment of key departmental/ provincial projects and determine funding needs. • Develop guidelines for applications for support. • Develop a financing plan along with incentive options in conjunction with the Provincial Treasury.	D:EA&DP Provincial Treasury	April 2007
Support the development of an energy programme in each Local Authority	Local Government energy programme	• Work with electricity and energy departments of Local Authorities to establish energy programmes and objectives that will support the Province's overall objectives and aims.	D:EA&DP Provincial Treasury and external advisors	June 2007
Establish RE/EE funding programme to support local government	REEE Funding Programme	• Conduct assessments to establish and support needs. • Support LG in developing financing programmes. • Agree funding mechanisms and options with Municipalities.	D:EA&DP DME Provincial Treasury	June 2007

CONCLUSION

The *Provincial Sustainable Energy Strategy and Programme of Action* has been designed with the aim of establishing a sustainable energy system across the Province that will assist in ensuring long term energy security for all stakeholders. The achievement of this goal will require the adoption of a new approach to energy planning that encourages greater levels of energy efficiency and that supports decentralised, renewable energy options as an essential component of the new energy system.

The Department recognises that the current energy intensive behaviour across all sectors of the Provincial economy is generally based on an assumption that regards current primary energy sources as cheap and limitless. Indications are that this is no longer the case and that future energy challenges must be addressed in a timely manner and wisely in order to ensure that the Province is not faced with serious energy challenges that will undermine the Provincial Growth and Development strategy.

This strategy and programme of action also attempts to address various hurdles to implementing a sustainable energy system. The Department believes it has addressed these challenges by suggesting a bold and progressive way forward that is supported by a broad range of local authorities, national government and by the Province's social partners represented in the Provincial Development Council.

Strategy development and implementation is a dynamic, ongoing process and this programme of action will be continuously reviewed and structured to suit the objectives of the overall strategy. It will accommodate new developments and challenges, embracing them with the enthusiasm that led to the development of the current strategy and programme of action.

The Department will also ensure that its capacity to effectively refine and implement the strategy is enhanced through various measures including securing additional staff to drive the programme.

This strategy and programme of action will be presented to the Provincial Cabinet as a Greenpaper. It will then be developed into a Whitepaper and some elements of the Whitepaper will be taken up in provincial legislation.

TERMS USED IN THIS DOCUMENT

Abbreviations:

AMEU	Association of Municipal Electricity Undertakings
CCT	City of Cape Town
CEF	Central Energy Fund
CFL's	Compact Fluorescent Lamps
CO_2	Carbon Dioxide
D:EA&DP	The Department of Environmental Affairs and Development Planning
DLG&H	Department of Local Government & Housing
DME	Department of Minerals and Energy
DOE	Department of Education
DOH	Department of Housing
D: T&PW	Department of Transport & Public Works
GJ	Gigajoules (see box below)
HVAC	an acronym for heating, ventilation and air conditioning
SES	Sustainable Energy Strategy
LED	light-emitting diode
LEDS	Local Economic Development Strategies
MEDS	Micro-Economic Development Strategy
NEEA	National Energy Efficiency Agency
NERSA	National Energy Regulator of South Africa
PDC	Provincial Development Council
PGWC	Provincial Government of the Western Cape
SEAT	Sustainable Energy Action Team
SDF	Spatial Development Framework
SIP	Strategic Infrastructure Plan
SWH's	Solar Water Heaters
TREC's	Tradable Renewable Energy Certificates
WESGRO	Western Cape Trade & Investment Promotion Agency

kWh = kilowatt-hour
GWh = gigawatt-hour (1,000,000 kWh = 1 GWh)
1 GWh = 3600 Gigajoules (GJ)
1 kg coal = 1.89 kWh
I kwh = 0.963 kg CO_2
1 kwh = 1.26 Litres of water used

A kilowatt-hour (kWh) is one unit of electricity; one 60 Watt light bulb burned for one hour will use 0.06 kWh (60 Watts) x (1 kilowatt/1000 Watts) x 1 hour) = 0.06 kWh

Glossary of Terms:

Biodiesel	Refers to a diesel-equivalent, processed fuel derived from biological sources, such as, vegetable-oils which can be used in *unmodified* diesel-engine vehicles.
Biomass Energy	Energy from the burning of agricultural, forestry, and other organic material (including landfill gas, digester gas, and municipal solid waste).

Carbon Footprint	A representation of the effect human activities have on the climate in terms of the total amount of greenhouse gases produced (measured in units of carbon dioxide).
Carbon Tax	A tax on energy sources which emit carbon dioxide into the atmosphere. It is an example of a pollution tax.
CFL	Compact Fluorescent Lamp – relatively efficient light bulbs, using about 25% of the power of incandescent light bulbs, for the same light output. It typically screws into a standard light socket.
Coal Thermal Power Plant/Station	A power station that generates electricity through the burning of coal.
Co-generation	The simultaneous production by means of a single source of useful energy (usually electricity) and heat (e.g. process steam) than can then be recovered for use as additional energy.
Climate change	A statistically significant difference noted either in the mean state of the climate or in its variability persisting for an extended period of time. Presently, climate change is thought to be caused by human activity, the most prominent being the generation of energy.
Electricity Grid	The electricity supply line system.
Energy	A measure of the ability to do work. E.g. energy is required to lift a bucket of water 10 metres, and a certain amount of energy is required to keep a light bulb alight for 1 hour. Basic unit of measurement is the Joule (J).
Energy Audit	A process whereby the energy use profile of an entity is determined i.e. amounts of energy used, types of energy used etc.
Energy Efficiency	Using less energy to achieve the same objective, e.g. an energy efficient air conditioner uses less energy to achieve the same cooling.
Energy Conservation	Measures to avoid the use of energy services.
ESCO	Energy Services Company. A company that specializes in energy efficiency measures under a contractual arrangement in which the company shares the value of energy savings with the customer.
Fossil Fuel	A fuel such as coal, oil, natural gas, produced from the decomposition of ancient plants and animals.
Fossil Fuel Power Station/Plant	A power station that generates electricity through the burning any fossil fuel.
Global Warming	An overall rise in the global temperature presently thought to be faster than the natural rate, due to human activity (see Climate Change).
Gigajoules	A gigajoule (GJ) is 1,000,000,000 joules. It is a unit of energy.
Natural Gas	A mixture of hydrocarbon compounds and small quantities of various non-hydrocarbons, widely used as a fuel throughout the industrialized world; it exists in the gaseous phase or in solution with crude oil in natural underground reservoirs.

Hydropower	Energy derived at a variety of scales from water pressure, especially the force or pressure of falling water used to power a water wheel, turbine, and so on.
Nuclear Energy	Energy released by radioactive decay, through a nuclear reaction, or in the course of fission or fusion of atomic nuclei.
Renewable Energy	Energy which can be replenished at the same rate it is used.
Solar Radiation	All the constituents that make up the total electromagnetic radiation emitted by the sun.
Sustainability	An attempt to provide the best social, environmental and economic outcomes for the human and natural environments both now and into the indefinite future.
Wave Power	Energy generated by the oceans' wave currents, especially wind-generated waves.
Wind Energy	The energy contained in the movement of air masses; in human energy use traditionally captured by means of the sails of a ship or the vanes of a windmill, and currently by mechanical blades similar to airplane propellers.

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SouthSouthNorth	www.southsouthnorth.org
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University of Cape Town	www.uct.ac.za
University of Cape Town – Energy Research Centre	www.erc.uct.ac.za
South Africa – Regional (Western Cape)	
Western Cape Provincial Government	www.capegateway.gov.za
Western Cape Trade and Investment Promotion Agency	www.wesgro.org.za
South Africa – National	
South African Department of Minerals and Energy	www.dme.gov.za
South African Government Information	www.info.gov.za
South African National Electricity Regulator	www.ner.org.za
International	
Australian Department of the Prime Minister and Cabinet	www.dpmc.gov.au
Canada – Natural Resources Canada	www.nrcan.gc.ca
Cities Energy Strategies Conference	www.sustainable.org.za/CESConference

Cities for Climate Protection	www.iclei.org/co2/
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