



**Western Cape
Government**

Environmental Affairs and
Development Planning



Western Cape Climate Change Response Strategy Biennial Monitoring & Evaluation Report 2015/16

Progress in preparing for climate change | March 2016

ABOUT THIS REPORT

This is the first report highlighting the implementation efforts relating to the focus areas outlined within the Western Cape Climate Change Response Strategy 2014 (WCCCRS). The document aims to:

- i) coordinate and bring sources of existing information and inputs from stakeholders together to achieve this purpose;
- ii) identify gaps and emerging areas of development, planning and implementation;
- iii) raise awareness of the urgency of responding to climate change in the Western Cape and our collective response in this critical societal and economic challenge, as well as eliciting further opportunities for partnerships and upscaling;
- iv) plot trends where these are available and surveyable, and identify emerging risks, gaps and opportunities; and
- v) provide an opportunity to influence strategic cross-sectoral economic and development planning in both the public and private sector of the Western Cape.

The document is not intended to be a report that tracks climate change hazards and risks (i.e. trends in temperature, rainfall etc.). Many of the impacts of climate change on sectors are discussed in the WCCCRS, and any information and updates on impacts, and trends will be provided in the next update of the Strategy planned for 2018 and/or in specific in-depth sector climate change strategies such as the 'Smart Agriculture for Climate Resilience – SmartAgri' Response Framework (2016). This report is also not intended to be a source of primary/newly collected data, unless they are ones that are already being tracked. At this stage we may not be able to track whether each of our efforts is the exact 'right response' to each climate related challenge, as many of these evaluations will not be possible with the current data availability, human resource base, knowledge and uncertainty with regards to some climate stimuli. The report will include information on these where they are obtainable and forthcoming from partners, and where rational conclusions and discussions can be derived.

LEAD AUTHORS

Sarah Birch, Lize Jennings-Boom, Frances van der Merwe, Goosain Isaacs, Western Cape Government, Department of Environmental Affairs and Development Planning, Climate Change Directorate

ACKNOWLEDGEMENTS

The Western Cape Government Climate Change Directorate would like to acknowledge the ongoing support from and collaboration with the Department of Environmental Affairs (DEA) in particular on sharing information, data and innovation in developing Monitoring and Evaluation (M&E) systems, indicators and reports on Climate Change. In addition we would like to thank the Provincial Strategic Goal 4 Climate Change Response Work Group and Forum and all of its members for ongoing support, and inputs into the development of this report. We are grateful to the many colleagues from within the Western Cape Government, local governments, private sector and other partner organisations who have contributed to the development of this report (See Annex 1 for a full list).

THE FUTURE OF THIS REPORT

This is the first iteration and ambitious attempt at developing a multi-sectoral climate change response stocktake for the Western Cape. It is anticipated that it will highlight recommendations and opportunities for strengthening our climate change response.

This report, along with additional national commitments to international climate change agreement decisions reached post-United Nations Framework Convention of Climate Change (UNFCCC) Conference of the Parties (COP) 21 Paris Agreement Global Stocktake, will assist in providing further clarity and a way forward on more informed targets both on reducing our emissions and on increasing our resilience.

Future iterations of this report will likely include an agreed set of proportional targets (based on national commitments) for both mitigation and adaptation. If however, this is not adequate, a set of ambitious provincial targets will be adopted.

As the WCCCRS 2014 is a strategy that covers activities of all stakeholders of the Western Cape, its scope is broad and thus reporting on its implementation equally as broad. Contact the coordinating team if you:

- i) wish to contribute to the report in future iterations,
- ii) have identified an indicator or data set that your organisation owns;
- iii) have identified an area/topic that should be covered in the next iteration of the Climate Change Response Strategy; or
- iv) would like to showcase innovative climate response projects and initiatives.

Contents

LIST OF FIGURES	6
LIST OF TABLES	8
INTRODUCTION	10
CONTEXT	12
GLOBAL CONTEXT	12
SOUTH AFRICAN CONTEXT	13
WESTERN CAPE CONTEXT	14
REPORT OBJECTIVES & PRINCIPLES	16
CROSS CUTTING CLIMATE CHANGE RESPONSES	18
CLIMATE RISK MANAGEMENT	26
WATER	31
FOOD SECURITY	37
ENERGY	42
WASTE MINIMISATION AND MANAGEMENT	52
SUSTAINABLE TRANSPORT	57
HUMAN SETTLEMENTS	64
BIODIVERSITY AND ECOSYSTEM GOODS AND SERVICES	68
COASTAL AND ESTUARY MANAGEMENT	75
HEALTHY COMMUNITIES	82
KNOWLEDGE MANAGEMENT, COMMUNICATIONS & RESEARCH	87
ANNEX 1: LIST OF CONTRIBUTING STAKEHOLDERS TO THIS REPORT	89
ANNEX 2: ACTUAL OBSERVED CLIMATE IMPACTS	90
ANNEX 3: STATE OF ENVIRONMENT OUTLOOK INDICATORS (2013)	92
ANNEX 4: ACRONYMS	96
PHOTOGRAPH CREDITS	98



LIST OF FIGURES

Figure 1.	Climate Change IDP Assessment results for the 2015/16 IDP review (based on the Climate Change IDP Assessment Framework)	21
Figure 2.	Indication of the bilateral and multilateral support SA has received / or that which has been committed by bilateral's to develop its climate change response [information is divided into Loans, and Other (i.e. Bilateral donor/grant funding)]	23
Figure 3.	Indication of the committed and received Multilateral support to SA bilateral and multilateral support SA to develop its climate change response(information divided into Loans (IFC, World Bank and Clean Technology Fund), and Grants (i.e. GEF and REEEP)	23
Figure 4.	Frequency breakdown of funding sources for self-reported Western Cape based climate change response projects (81 projects, 2011 - 2015). Note that this is not a representation of total funding amounts	24
Figure 5.	Frequency breakdown of how often Western Cape based climate change response projects fall into particular WCCCRS focus areas (all projects, 2011 - 2015)	25
Figure 6.	Registered water use per WMA - Western Cape Areas	33
Figure 7.	CO ₂ emissions from energy use by sector and fuel type for 2009 and 2012/13 (a. Emissions by Sector for Western Cape (CO _{2e}) (2009); b. Emissions by Sector (CO _{2e}) (2012/13); c. Emissions by Fuel for Western Cape (CO _{2e}) (2009); d. Emissions by fuel (CO _{2e}) (2012/13)	44
Figure 8.	Total SWH Installations per year on Eskom rebate	49
Figure 9.	Renewable Energy Development Zones identified as part of the National Wind and Solar PV Strategic Environmental Assessment	50

Figure 10.	Waste and energy related CO _{2e} emissions by sector for the Western Cape (%)	52
Figure 11.	The Waste Management Hierarchy	53
Figure 12.	Waste stream analysis for the Western Cape (2010)	54
Figure 13.	Energy Consumption by Sector for the Western Cape (GJ; 2013/13)	58
Figure 14.	Percentage of provincial land transport energy used per district	59
Figure 15.	Percentage of land in the Western Cape that is under conservation management by CapeNature (CapeNature Annual Reports: 2012/13; 2013/14; 2014/15)	70
Figure 16.	Degree to which biodiversity priorities were integrated into Western Cape municipal Spatial Development Frameworks	72
Figure 17.	Percentage of the Western Cape estuaries classified under the various ecological rating categories (NBA 2011)	78
Figure 18.	Degree of inclusion of Climate Change (CC) and sea level rise issues in Western Cape Estuary Management Plans (note that many of these plans are still in draft form awaiting final approval)	80
Figure 19.	Leading causes of death, measured in years of potential life list (TLL), for all persons in Western Cape, 2010 – 2012	83



LIST OF TABLES

Table 1.	Climate Risk Management Indicators for the WCCCRS	26
Table 2.	Additional High Level Climate Risk Management Indicators	26
Table 3.	Recent Western Cape Disaster Management Tools	29
Table 4.	Water Indicators for the WCCCRS	31
Table 5.	Additional High Level Water Related Indicators	31
Table 6.	A comparison of the overall water resource supply and consumption between 2000 and 2005, per Water Management Area	32
Table 7.	Food Security Indicators for the WCCCRS	37
Table 8.	Additional High Level Food Security Indicators	37
Table 9.	Energy Indicators for the WCCCRS	42
Table 10.	Sustainable energy indicators for the Western Cape	43
Table 11.	Multi-criteria analysis rank by emissions abatement top 20 mitigation measures	45
Table 12.	Key performance data for WCG buildings (energy and water consumption)	46
Table 13.	Energy Efficiency and Demand Side Management Grant for Western Cape municipalities in 2014/15	47
Table 14.	The number of Western Cape municipalities with SSEG regulations and tariffs.	51
Table 15.	Waste Indicators for the WCCCRS	52
Table 16.	Estimated waste generation in Western Cape District Municipalities (2010)	55
Table 17.	Energy consumption and emissions per district for the transport sector	55
Table 18.	Modal Split by transport mode in districts	58

Table 19.	Human Settlements Indicators for the WCCCRS	60
Table 20.	Human settlement policies and programmes relevant to climate change response.	64
Table 21.	Housing targets set by the WCG:DoHS for the construction of houses using innovative technology initiatives such as construction, energy, water, and sanitation.	66
Table 22.	Housing targets set by the WCG: DoHS for the construction of houses complying with the updated National Norms and Standards for the Construction of Stand Alone Residential Dwellings and Engineering Services	67
Table 23.	Biodiversity and Ecosystem Goods and Services Indicators for the WCCCRS	67
Table 24.	Additional High level Biodiversity and EGS Indicators	68
Table 25.	Number of wetlands rehabilitated in the Western Cape, 2013 - 2016	68
Table 26.	Biodiversity and Ecosystem Goods and Services Indicators for the WCCCRS	73
Table 27.	Additional High Level Coastal & Estuary Indicators	75
Table 28.	Ecological management category classifications for estuaries (DWAF 2008)	75
Table 29.	Progress and approval status of coastal management lines and coastal risk overlays in the Western Cape (Data source: Coastal Impact Management Component, DEA&DP)	77
Table 30.	Health Indicators for the WCCCRS	79
Table 31.	Additional High Level Health Indicators	82
Table 32.	Additional High Level Health Indicators	82



INTRODUCTION

The science on climate change is unequivocal – it is happening, it is anthropogenic in origin and it is happening in a ‘worst case scenario’ as global responses are proving to be inadequate. Although the outlook is one that is dismal, climate change also presents us with the most unprecedented opportunity of our time to leapfrog our development practices to be more just, equitable, innovative and sustainable.

Broadly, the scientific consensus is that sub-Saharan Africa, given its geographic location straddling the equator, will experience the greatest negative effects of global warming of any region. For South Africa, under the current emissions trajectory, this is projected to be an average increase above the 20th century average of 1.5°C around the coast, to 3°C in the interior, by 2050, with a doubling of these figures to 3°C and 6°C by the end of the century. As a result, coastal regions like the Western Cape are likely to see significant in-migration from the interior of the country (as well as from further north on the continent).

Globally, 2015 was the hottest year recorded since modern records began, with 14 of the hottest 15 years recorded all occurring in this century. The global average temperature increase has already reached 1°C as of December 2015, and 2016 has seen alarming consecutive records set of 1.15°C and 1.35°C above the long term average for January and February respectively¹. Furthermore, globally, 90% of all disasters are now climate-related², and since the first UNFCCC COP in 1995 over 600,000 lives have been lost and 4.1 billion people injured, left homeless or in need of emergency assistance as a result of weather-related disasters³. In South Africa, 2015 represents the lowest national annual rainfall since 1904⁴. Tuesday March 3rd 2015 was the highest temperature recorded in the last 100 years in Cape Town at 42°C, and this coincided with severe fires. The fires season for 2015/16 thus far has broken previous records (although publishable data will only be released later in 2016)⁵.

In recognition of the urgent need to rapidly reduce greenhouse gas (GHG) emissions and adapt to climate changes already being experienced, the Western Cape Government (WCG) recognises the necessity to contribute to global efforts to reduce its GHG emissions, particularly with a longer-term view to reducing climate change impacts to 1.5°C globally as agreed at the UNFCCC COP21 in the Paris Agreement in December 2015. Equally significant, the WCG also recognises the need to adapt to the impacts of the unavoidable climate changes already occurring and those in the longer term, particular as it is the most disaster prone province in South Africa⁶. Historical methods of dealing with climate hazards will not be sufficient to cope with the frequency and magnitude of anticipated climate change impacts.

Planning, preparedness, and innovation are therefore required to maximise the province's adaptive capacity to this global threat. Taking action now will limit damages, loss of life, and economic costs over the coming decades and, if strategically and urgently considered, will add to the Western Cape's global competitive edge into the future. Trade-offs in terms of provincial short term priorities may have to be made, however, and it is imperative that these are explicit rather than realising unintended consequences as a result of disastrous events. We have an imminent window of opportunity that presents us with exciting and innovative growth paths for the Western Cape.

The Stern Review completed in 2006 estimated that the percentage of global governments' Gross Domestic Product (GDP) being consumed by recovering from climate related disasters could increase to between 5% and 20% by 2100, although these figures may be even greater in the current context. Against the backdrop of the socio-economic challenges facing the country and the province, such increased disaster recovery costs pose a significant risk to the achievement of the Western Cape's growth and development goals (including those related to job creation).

Short, medium and long term adaptation interventions designed to ensure that the Western Cape does not compromise its growth and development strategy are, therefore, critical to ensuring reduced vulnerability to the impacts of climate variability and climate change across the province.



¹ https://www.theguardian.com/science/2016/mar/14/february-breaks-global-temperature-records-by-shocking-amount?CMP=share_btn_tw

² http://www.un.org/apps/news/story.asp?NewsID=53418#.VuK5_PI97IX

³ CRED. 2015. The Human Cost of Weather Related Disasters (1995 -2015).

⁴ Bureau for Food and Agricultural Policy. 2016. Policy brief on the 2015/2016 drought. Whilst annual rainfall is a logical departure in comparing different production seasons, it does not present the entire picture, as the monthly distribution of rainfall is as important a consideration in the context of agricultural production.

⁵ Tony Marshall, CapeNature, Pers. Communication.

⁶ RADAR Western Cape. 2010. Risk and Development Annual Review.



CONTEXT

GLOBAL CONTEXT

Since the development of the WCCCRS, the global context on climate change has reached several catalytic turning points. Of pivotal importance, nations reached a global agreement at the United Nations Framework Convention on Climate Change (UNFCCC) – 21st Conference of the Parties (COP21), ‘the Paris Agreement’, on 12 December 2015. The key commitment by all nations is holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. This will require all nations to provide targets towards contributing to these emissions reductions. Governments agreed on the need for global emissions to peak as soon as possible, recognizing that this will take longer for developing countries; and to undertake rapid reductions thereafter in accordance with the best available science. The global community has also established a global goal on adaptation – on enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response across all sectors in the context of the temperature goal. There is thus important work which will need to be undertaken nationally, provincially and locally to ensure that our targets are appropriate to ensure proportionate contributions and adaptation responses. The South African Intended Nationally Determined Contribution (INDC) will spell out how this progress will be achieved in South Africa (see section below).

Significant progress has also been made in shaping a post-2015 development agenda, and the Sustainable Development Goals (SDGs, which includes 17 goals) were agreed upon in 2015 to replace the Millennium Development Goals. Among the SDGs, the responsibility for the climate goal is handed over to the UNFCCC. This is the only body subject to binding targets for the SDGs. The SDGs themselves are not binding; it is up to the individual governments to decide how to implement them. The main goal of the climate objectives (to keep the rise in global average temperature below 1.5 to 2°C) and the main goals of the SDGs (including poverty eradication by 2030) should, however, be central to all development measures and cannot be compromised. In addition to the SDGs, advancement was made in 2015 that speaks directly to the economic and social impacts of climate change. The United Nations International Strategy for Disaster Reduction (UNISDR) facilitated the process of developing the Sendai Framework for disaster risk reduction (which replaces the Hyogo Framework) which has strong cross linkages with climate change adaptation and resilience. The strong link to disaster risk is pivotal as is identified by the World Economic Forum in their latest annual report on the top global risks – the top 10 risks include five directly related to climate change: extreme weather

events, natural catastrophes, failure of climate change adaptation, water crises; the remaining five risks have linkages to underlying climate change related impacts.

SOUTH AFRICAN CONTEXT

The National Climate Change Response White Paper (NCCRWP 2011) presents the South African Government's vision for an effective climate change response and a long-term, just transition to a climate-resilient and lower-carbon economy and society. South Africa's response to climate change has two objectives:

1. Effectively manage inevitable climate change impacts through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity; and
2. Make a fair contribution to the global efforts to stabilise GHG concentrations in the atmosphere at a level that avoids dangerous anthropogenic interferences with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner.

The National Climate Change Response White Paper highlights eight near-term Priority Flagship Programmes that will be undertaken in the immediate future. These include:

- The Climate Change Response Public Works Flagship Programmes;
- The Water Conservation Flagship Programme;
- The Energy Efficiency and Energy Demand Flagship Programme;
- The Transport Flagship Programme;
- The Renewable Energy Flagship Programme;
- The Waste Management Flagship Programme;
- The Carbon Capture and Sequestration Flagship Programme; and
- The Adaptation Research Flagship Programme.



Further at the national level, South Africa has developed a 'flagship research project', on Long-term Adaptation Scenarios (LTAS, DEA 2014). The Long Term Adaptation Scenarios (LTAS) are designed to provide a consistent framework for adaptation planning for the country, as well as identify as early as possible where significant trade-offs may need to be made in terms of both national and sub-national development targets, for example, over competing water use. The LTAS brief on Water states unequivocally that 'Climate change impacts on South Africa are likely to be felt primarily via effects on water resources; significant trade-offs are likely to occur between developmental aspirations...with significant social, economic and ecological consequences through restricting the range of viable national development pathways'. The LTAS series of reports produced since the development of the WCCCRS are a critical resource for guiding downscaled action at the provincial level and useful resource for all sectors to utilise.

As part of the national mitigation agenda, Desired Emission Reduction Outcomes (DEROs) are referenced in the NCCRWP, as one of the key elements for the implementation of South Africa's long-term climate mitigation goal. DEROs are intended to serve as a strategic point of departure for the implementation of policies and measures intended to meet South Africa's long-term climate mitigation goals - a roadmap to a low-carbon future, and are not intended to play a regulatory role in themselves. The Carbon Tax Bill (2015) as well as the declaration of Greenhouse gas emissions as priority pollutants under the National Environmental Management: Air Quality Management Act (Act 39 of 2004)(gazetted for comment in 2016), will also strongly support the mitigation agenda in South Africa by putting requirements in place on industry and other sectors to reduce their emissions and report on these reductions.

National government has set itself the target (in Outcome 10 2014-2019) to have a Climate Change monitoring and evaluation (M&E) system finalised in 2016/2017 with the first monitoring and evaluation report scheduled for publication in 2017/2018. The national Department of Environmental Affairs (DEA), as custodians for international climate change reporting obligations, is responsible for the design and publication of the national monitoring and evaluation system. Part of the intention of this reporting exercise within WCG is to prepare for contributing to the national M&E, and assess the degree to which this is feasible in various themes.

WESTERN CAPE CONTEXT

The Western Cape Climate Change Response Strategy⁷ (WCCCRS) was approved by the Western Cape Cabinet in 2014. The Strategy is developed as a coordinated climate change response; it aims to guide the implementation of innovative projects and the search for opportunities that combine a low carbon development trajectory with increased climate resilience, enhancement of ecosystems and the services they provide, and economic stability and growth. The WCCCRS, which is aligned to the NCCRWP, also acknowledges the important role that sub-national governments play in responding to climate change, since adaptation and mitigation actions necessary to tackle climate change are, or will

⁷https://www.westerncape.gov.za/text/2015/march/western_cape_climate_change_response_strategy_2014.pdf

be, implemented at this level of governance. Subnational governments are willing to address the issues of climate change and the economic difficulties many of them are facing, by turning these challenges into an opportunity. The WCCCRS document highlights nine focus areas:

- Energy efficiency;
- Renewable energy;
- Built environment – critical infrastructure, disaster management, integrated waste management, human settlements;
- Sustainable transport;
- Water security and efficiency;
- Biodiversity and ecosystem goods and services;
- Coastal and estuary management;
- Food security; and
- Healthy communities.

Building on the WCCCRS, in August 2014, the Western Cape Climate Change Response Implementation Framework was released. This discussed each focus area in greater detail in order to identify impact potential / benefit for the priority programmes and to discuss the opportunities for and barriers to the implementation of the priority programmes identified in the strategy document. The impact potential / benefits were then used to finalise a set of indicators that could be used in this M&E report.





REPORT OBJECTIVES & PRINCIPLES

The overarching objectives of this report, which will be published every two years, over time will be to track the transition to a low carbon and climate resilient Western Cape through the implementation of the WCCCRS.

THIS WILL INCLUDE:

- Providing a clear picture of the various response measures included in climate change mitigation and adaptation programmes;
- Providing an assessment of the effectiveness of these response measures, where feasible;
- Moving towards a consistent approach to these assessments to allow for greater comparability, where feasible;
- Increasing co-ordination of climate change response measures and M&E;
- Demonstrating the impact of response measures over time;
- Increasing transparency on finance flows relating to climate responses; and
- Increasing awareness of observed and projected climate impacts.

As climate change impacts all sectors, this is a highly ambitious, complex and yet critically important piece of work for all economic sectors, public and private sector implementers, and communities alike. It is complex, not least because of the uncertainty of the exact climate change impacts we will experience, but due to the plethora of activities required to respond by a multitude of different actors. Many organisations and stakeholders are grappling globally with the scope and extent of climate change responses required and the way in which to track and monitor them.

The WCCCRS was developed in a manner that would focus in on specific programmes of work, and thus whilst covering most of the key sectors of the economy and governmental functions at provincial and local level, the degree of focus of each is not extensive, but rather specific and focused on priority programmes. These focus areas have been selected based on the urgency of action required. In many cases, work in these focus areas is already being implemented by WCG departments, local authorities, the business sector, non-governmental organisations (NGOs) and other key stakeholder groups. The focus areas will include both the scaling up of existing climate change initiatives and the development of required new initiatives. There is thus opportunity to additionally shift the scope and to adaptively manage our climate change response as new and emerging priorities surface and our knowledge base improves. The focus areas will be reviewed every five years to assess the relevance of those selected for the last period and to address priorities for that period. If necessary, the focus areas may be adjusted to a sectoral approach in order to mainstream climate change into all programmes.

The authors have thus taken a pragmatic approach to initiating this reporting platform with this first iteration biennial report. It thus takes the WCCCRS 2014 as impetus, in firstly responding to and reporting on progress being made in the identified focus areas. Some additional information is also provided that may sit outside of these focus areas, along with some data and discussion of underlying vulnerability. Each section has some follow up recommendations for future analysis, action and focus. It thus aims to build a robust platform upon which we can all collectively build our knowledge base.





CROSS CUTTING CLIMATE CHANGE RESPONSES

INSTITUTIONAL ARRANGEMENTS & GOVERNANCE

The current Provincial Strategic Plan sets out the Western Cape Government's vision and strategic priorities 2014-2019, and together with the five Strategic Goals, will contribute to continuous improvement in the lives of its citizens. These are:

1. Strategic Goal One: Creating Opportunities for Growth and Jobs;
2. Strategic Goal Two: Improving Education Outcomes and Opportunities for Youth Development;
3. Strategic Goal Three: Increasing Wellness, Safety and Tackling Social Ills;
4. Strategic Goal Four: Enabling a Resilient, Sustainable, Quality and Inclusive Living Environment; and
5. Strategic Goal Five: Embedding Good Governance and Integrated Service Delivery through Partnerships and Spatial Alignment.

At the core of Provincial Strategic Plan (PSP) 2009-2014 was the understanding that no government can, by itself, guarantee a better life. Progress can only be realised through partnerships amongst government, citizens, civil society, academia and business. Each has a role and specific responsibilities. To this effect and to ensure that climate change is mainstreamed across all WCG activities, a transversal Climate Change Response Work Group has been established under Strategic Goal 4. Similarly a Climate Change Response Forum has been established to act as a platform for broader stakeholders to interact with WCG on climate change issues which significantly contribute to building regional resilience to climate change impacts.

The Climate Change Response Work Group and Forum currently focus on three programmes:

- Western Cape Climate Change Response Implementation - the programme will track implementation of the WCCCRS focus areas and associated priority programmes;
- Climate Change Partnerships, Opportunities and Co-operation - partnerships with key stakeholders are paramount to maximise effective implementation of climate change response programmes; and
- Ecological Infrastructure for Resilience Programme - this programme will address areas of ecosystem resilience as it pertains to climate change.

POLICY ALIGNMENT

Responding to climate change is a transversal priority for the Western Cape Government and requires responses and accountability within all departments. Furthermore, it requires the implementation of key overarching strategic directions for economic growth, investment, and social upliftment, which are informed by climate impacts and threats. One of the critical aspects of the Western Cape Climate Change Response Strategy is that it must be owned across the whole of provincial government and all associated stakeholders. It must thus be carried out, at the most strategic level, by mainstreaming the key priorities directly into other sectors policies and plans, and overarching strategies that will require critical analysis of policy trade-offs. The expected benefits of mainstreaming climate change adaptation and mitigation into development activities include avoided policy conflicts; reduced risks and vulnerability; greater efficiency compared to managing climate change separately, and; the potential of leveraging much larger financial flows in sectors affected by climate risks than the amounts available for financing climate change separately. Lastly it will allow for a defensible response on the part of provincial government to stakeholders and citizens that the best contemporary science has been utilised systematically in our decision- and policy-making, reducing the future potential for negative legal and accountability responses.

The National Department of Environmental Affairs and Development Planning (DEA), as part of the Long Term Adaptation Scenarios (LTAS) process, undertook a policy review exercise, which reviewed the key national policies in the themes covered by the LTAS (including Water, Health, Agriculture and Forestry, Biodiversity, and Human Settlements) in terms of the objectives of the LTAS. This exercise proved very useful in identifying areas of policy misalignment in the national climate change response; a similar exercise was also undertaken in terms of mitigation priorities.

Over the last few years, a number of key WCG strategies and policies have been developed that have or need to incorporate climate change considerations, and it was therefore determined that a policy alignment exercise similar to the national policy review should be undertaken to assess the level of climate change integration into WCG policy. This policy alignment exercise will serve as a high level analysis in terms of policies' alignment / misalignment with the key components of the WCCCRS. It will also provide the WCG with initial guidance on next steps required to undertake further complex modelling and scenario and systems analysis of different policy decisions under a changing climate.

Policies reviewed in the first phase of the exercise include the Provincial Spatial Development Framework (2014), Green Economy Strategy Framework (2013), Western Cape Infrastructure Framework (2013), Provincial Land Transport Framework (currently being revised), the Western Cape Sustainable Water Management Plan (2012), and HealthCare 2030 Plan (2014).

MUNICIPAL SUPPORT

Municipalities play a vital role in addressing the country's social, economic and environmental needs. Local government is tasked with the provision of services in a sustainable and equitable manner which includes climate change resilience, the facilitation of social and economic development and the promotion of a safe and healthy environment for all. Climate change and climate variability already have a direct impact on the ability of municipalities to meet these objectives. Extended dry seasons, increasing temperatures, extreme storms (including hail) and sea level rise, are resulting in impacts such as: drought, crop loss/failure, livestock death, damage to infrastructure, runaway fires, vector-borne disease, loss of livelihoods and damage to household assets.

In response to an uncertain future and immediate development needs, municipalities need to align climate responses with existing climate and development challenges and deepen existing response capacity as well as:

- Develop links with research institutions and community bodies to improve the flow of information, in particular early warning systems, for extreme events;
- Incorporate climate change information into sector planning and plan for a wide range of longer term changes in average conditions;
- Improve cross-sector integration of management and development planning. As mitigation and adaptation efforts fall under the responsibility of a range of departments, some form of institutional coordination is important; and
- Move hard and faster on core development objectives, which will provide immediate benefits and long-term climate response benefits.

Climate change covers all sectors and integrating climate change into existing policies and plans is considered the most effective way to respond to climate change. This approach builds increasing flexibility into planning decisions and helps to avoid “lock-in” systems or infrastructure not suitable to future climate conditions.

The Climate Change Municipal Support Programme within WCG: EADP was initiated in 2012 from an expressed need by municipalities for support on climate change and led to a programme to support municipalities in the development of Climate Change Response Frameworks and Plans. As the first Province in South Africa to roll out such a programme we have been at the forefront of learning and modifying this programme as it has developed to create best practices for the country. The Climate Change Municipal Support Programme forms part of the larger WCG: Municipal Support Programme. It has strong linkages with the DEA Local Government Support Strategy and Back-2-Basics programmes. WCG is working on knowledge sharing with South African Local Government Association (SALGA) through Working Groups and Peer Learning exercises.

WCG is also monitoring and evaluating the progress of municipalities in responding to climate change. In assessing this, an annual Integrated Development Plan (IDP) assessment of all local and district IDPs is undertaken utilising a Climate Change IDP Assessment Framework. This framework was developed to assess the integration of all climate change responses in municipal IDPs and sector plans.

The municipal IDPs are then scored according to one of the following categories, as shown in Figure 1:

- Non-performance: climate change is not included, or only briefly mentioned in the text of the document;
- Compliance performance: specific climate change response programmes/projects are included in the IDP; or
- Optimum performance: specific climate change response programmes / projects with budget and capacity are included in the IDP.

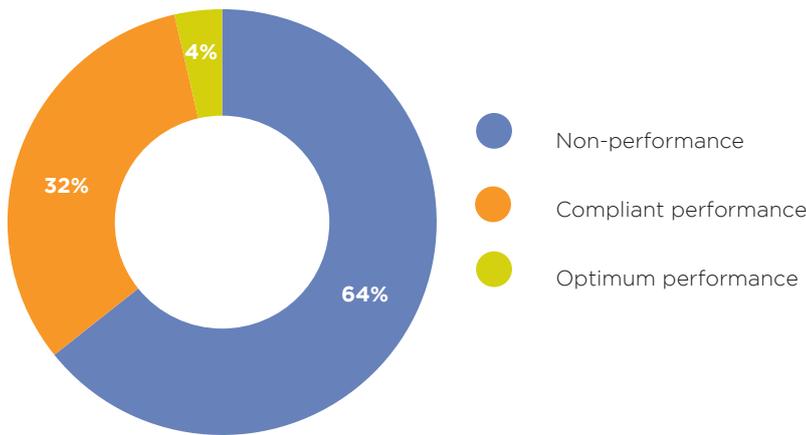


FIGURE 1. Climate Change IDP Assessment results for the 2015/16 IDP review (based on the Climate Change IDP Assessment Framework)

The WCG Greenest Municipality Competition also contains a comprehensive assessment of climate change response – questions are designed to not only provide a platform for competing in the competition, but also as a mechanisms to upscale local government responses on climate change integration into planning.

CLIMATE CHANGE FINANCE

The current WCCCRS acknowledges that climate change will pose significant challenges to government, private sector and civil society into the future, and as such presents an enabling and pro-active framework for influencing planning and decision-making. From a finance perspective, major financial investments – from both public and private sources and guided by climate appropriate policies – are required to transition economies to a low-carbon path, and build the resilience of vulnerable countries to climate change. These significant new and emerging opportunities can be realised through:

- Collectively responding to the economic and social changes necessary for climate-resilient development and job creation, providing for the economic and social upliftment of communities, while minimising negative impacts in the future;
- Promoting the green economy as an effective means of contributing towards the climate change response, and securing resources to support these interventions;
- Consolidating and extending existing initiatives towards a climate resilient economy; and
- Landscape for financial flows.

One of the primary constraining factors to transitioning to a low carbon and climate resilient Western Cape is finance; an issue that is complex, requires trust among parties and is politically sensitive. In developing countries, climate change investment needs are significant. Direct government funding is generally scarce and the billions of dollars committed by industrialised countries remain inadequate to the magnitude of the challenge of stabilising a steep trajectory of greenhouse gases and responding to the associated impacts⁸.

In the 2009 Copenhagen Accord, developed countries pledged to raise US\$ 30 billion by 2012, increasing to US\$ 100 billion per year by 2020, to support climate change projects in developing countries. These commitments were reiterated in the Cancun decision (2010), the Durban Platform in 2011 and the Paris Agreement in 2015. The current annual finance goal is set to continue until 2025 when a new collective goal will be set.

BOX 1 PROGRESS TOWARDS THE US\$ 100 BILLION GOAL FOR CLIMATE FINANCE

2012: Multilateral Development Banks (MDBs) provided approximately US\$27 billion in financing to address the challenges of climate change in 2012. Seventy eight percent or US\$21 billion, was dedicated to mitigation, and 22%, or nearly US\$6 billion, to adaptation⁹.

2012-2013: Estimated aggregate volume of public and private climate finance mobilised by developed countries for developing countries reached US\$ 61.8 billion in 2014, up from US\$ 52.2 billion in 2013. A large share of the rise was due to a substantial increase in outflows from MDBs¹⁰.

South Africa is committed to mobilising the resources that are necessary to overcome the challenges in mitigating and adapting to climate change¹¹. Under the United Nations Framework Convention on Climate Change (UNFCCC), there are climate finance channels and instruments available for accessing funds. Theoretically, South Africa as a developing country has access to this finance. An assessment of country case studies highlighted that a mixture of four broad categories of funding sources were utilised to finance Climate Change Response projects: International Climate Funds; Bilateral and Multilateral Development Assistance; Domestic Public sector; and Private Sector Financing.

⁸ OECD (2015), "Climate finance in 2013-14 and the USD 100 billion goal", a report by the Organisation for Economic Co-operation and Development (OECD) in collaboration with Climate Policy Initiative.

⁹ JOINT REPORT ON MDB CLIMATE FINANCE 2012 (November, 2013). <http://www.ebrd.com/downloads/sector/sei/climate-finance-2012.pdf>

¹⁰ OECD (2015), "Climate finance in 2013-14 and the USD 100 billion goal", a report by the Organisation for Economic Co-operation and Development (OECD) in collaboration with Climate Policy Initiative.

¹¹ South Africa's First Biennial Update Report, 2014.

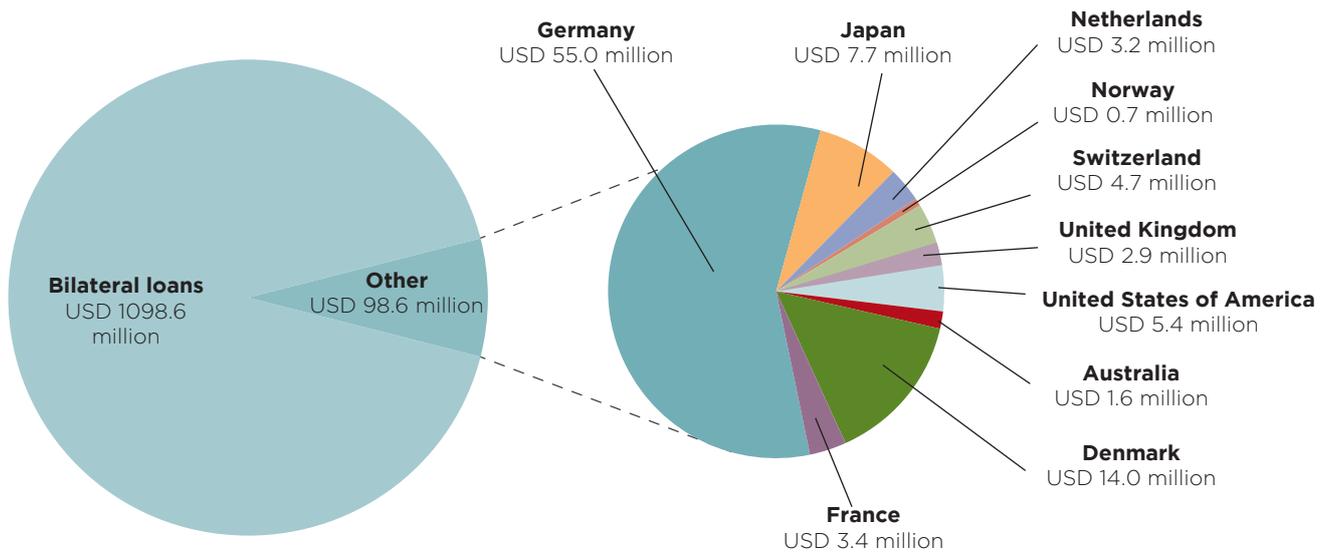


FIGURE 2. Indication of the bilateral and multilateral support South Africa has received / or that which has been committed by bilateral's to develop its climate change response¹² [information is divided into Loans, and Other (i.e. Bilateral donor/ grant funding)]

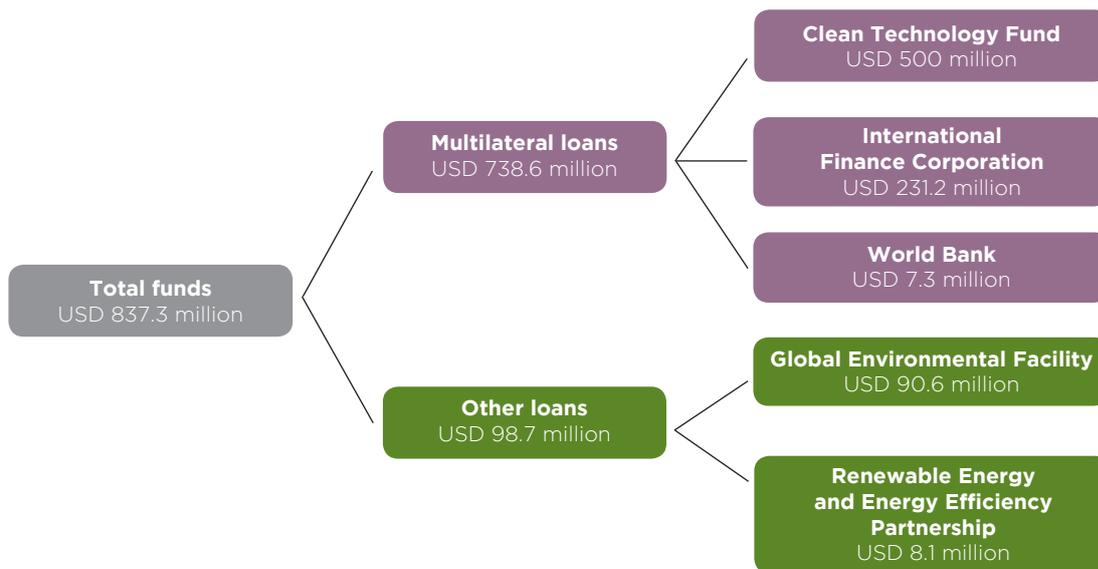


FIGURE 3. Indication of the committed and received bilateral and multilateral support SA to develop its climate change response¹³ (information divided into Loans (IFC, World Bank and Clean Technology Fund), and Grants (i.e. GEF and REEEP))

With regard to the domestic public sector financing, the South African Government has between 2003 and 2014 received from international climate financing instruments for climate change projects. Of this finance, US\$524 million targeted mitigation projects and US\$6.78 million were earmarked for adaptation projects. Financial instruments and support provided to South Africa consists of loans (85%), grants (5-10%) and technical assistance (5%). Of particular concern with regards to the high level of loans forming the bulk of climate change assistance is the ability of municipalities to access loans, particular those being downgraded financially. The support is mainly focused on energy

¹²South Africa's First Biennial Update Report, 2014.

¹³ South Africa's First Biennial Update Report, 2014.

efficiency and renewable energy projects with smaller allocations to natural resource management, climate policy and demonstration of other green technologies. In addition to the allocation for environmentally related public expenditure in the national budget, the South African Government has established and supported a number of climate specific budget allocations - the Department of Energy's (DoE) Energy and Eskom's Energy Efficiency/Demand Side Management (EEDSM) grant; National Green Fund (GF) administered by the DBSA; National Treasury's Cities Support Programme (CSP); and various public grants such as the regional bulk infrastructure grant, the municipal drought relief grant and the municipal and provincial disaster grants¹⁴. Not all of these cover climate change only, and not all of them cover both adaptation and mitigation in a comprehensive response to ensure that perverse inadvertent maladaptation or increase in carbon occurs (in mitigation and adaptation focused projects respectively).

Subnational governments have been able to access some sources of funding with varying degrees of success; indicating that municipalities and provincial government departments are willing to engage in climate change response projects. These sources include international multilateral and bilateral grants; municipal own revenue; intergovernmental grants to both municipalities and provinces; and concessionary loans for very large infrastructure projects. However, the ability of smaller municipalities to access finance, or raise finance is limited, and the ability of all municipalities to upscale and replicate projects is challenging¹⁵. This scenario has led to the WCG:EADP partnering the Government Technical Advisory Centre at National Treasury to conduct a study to identify the specific perceived or real regulatory barriers hampering investment in climate mitigation and adaptation projects.

Figure 4 provides an indication of where funding opportunities for climate change response projects in the Western Cape originates, as self-reported in 81 projects in the Western Cape Climate Change Response Projects Database (CCRPD; as of March 2016).

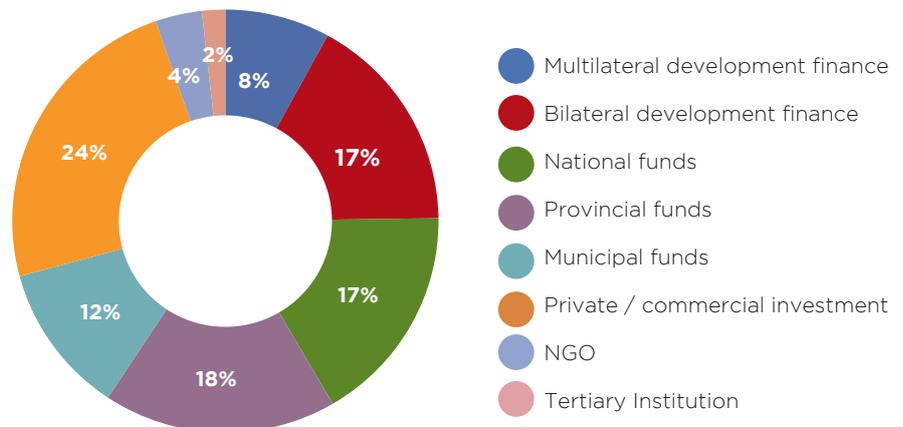


FIGURE 4. Frequency breakdown of funding sources for self-reported Western Cape based climate change response projects (81 projects, 2011 - 2015). Note that this is not a representation of total funding amounts¹⁶

¹⁴ Increasing Investment in Climate Change Related Projects at the Sub National Level- report, 2013.

¹⁵ Increasing Investment in Climate Change Related Projects at the Sub National Level- report, 2013.

¹⁶ It is important to note that this figure only indicates the direct source; in some cases the ultimate source may be different from the one reported. For instance, a project may report that their funding originated from a national government entity, which may in turn have received the funds from a multinational funding source.

Figure 5 gives an indication of the percentage of projects reported on in the CCRPD which fall into the various focus areas defined in the WCCCRS. It is clear from the figures that the bulk of the focus of finance is on emissions reductions, with very limited focus on resilience and climate change adaptation. This may seem particularly concerning for infrastructure, the built environment, food security, water and human settlements where the largest financial risks lie, and where the greatest losses are already being observed. However, the adaptation part of the database is not as robust as the energy part of the database and in this current iteration such conclusions may not yet be fully warranted. The general consensus is that more funding is still being allocated towards mitigation than adaptation, but the database is not a full reflection of the actual numbers. Massive upscaling of adaptation finance is however required, and for integration of climate change risks into all development planning and infrastructure investments.

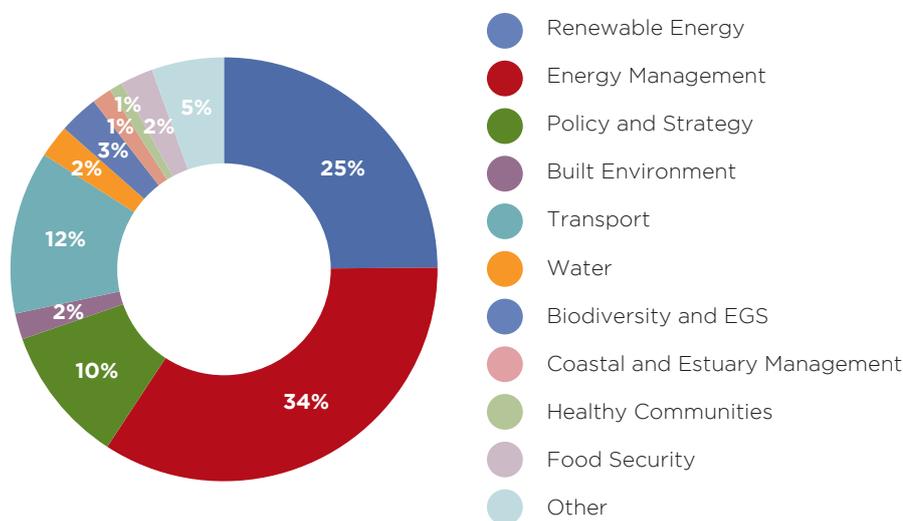


FIGURE 5. Frequency breakdown of how often Western Cape based climate change response projects fall into particular WCCCRS focus areas (all projects, 2011 - 2015)

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

- Absence of a simple and effective mechanism to raise adequate finance for climate change response projects. The global climate finance architecture is complex and in the process of continuous reform; thus accessing International Climate Finance requires a high level of capacity and expertise to prepare and package the projects according to rigorous and unfamiliar requirements.
- Capacity challenges and drafting of project concepts/bankable proposals.
- Lack of support for feasible provincial and local government climate change projects e.g. from private financiers.
- Challenges relating to upfront costs and long pay back periods of implementing technology changes.
- Accuracy of projected returns to finance investment in climate change response projects linked to new or alternative technology.
- Developing indicators for tracking climate finance flows in the Western Cape and mechanisms for collecting data on the finance flows.



CLIMATE RISK MANAGEMENT

The current priority areas for addressing climate change related disaster management is through a move towards climate risk management in the Western Cape and includes the initial focus on:

- i) Consideration and incorporation of climate change into disaster management plans across the province.

Since the development of the WCCRS, a new Disaster Management Amendment Act (Act no. 16 of 2015) has been promulgated, and as such specific focus areas for climate change integration may shift over the next two year reporting period.

TABLE 1. CLIMATE RISK MANAGEMENT INDICATORS FOR THE WCCRS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Spatial risk and vulnerability assessment for climate change	Provincial Spatial Climate Change Risk and Vulnerability Assessment.	Provincial Risk profile is under development and will include climate change. A specific spatially explicit climate change R&V assessment has not yet been undertaken.
	Number of Municipal Climate Change Risk and Vulnerability assessments	Varying degrees of Risk and Vulnerability (R&V) assessment exist for municipalities on some climate change related risks (specifically flooding), however, the degree to which these systematically cover the full range of climate change risks is currently not fully assessed.

TABLE 2. ADDITIONAL HIGH LEVEL CLIMATE RISK MANAGEMENT INDICATORS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Economic costs of disasters	Losses from climate related disasters in the Western Cape between 2003 - 2014.	R 5 billion (2003 - 2014) (2003 - 2008 ¹⁷ and 2003-2014 ¹⁸ data was utilised) (floods and storms)
	Losses from the El Nino and climate change driven drought of 2015/16 and associated fires in the Western Cape.	± R2 - 4 billion (Projected impact on Agriculture: loss of 5-10% of normal production) ¹⁹

* There is an overlap in data for these two figures due to the sources.

The Western Cape is prone to the effects of climate-related hazards, which pose a significant risk to the Western Cape's economy, ecosystems and population. Between 2003 and 2008 alone, direct damage costs associated with climate related extreme events in the Western Cape amounted to approximately R3 161.1 million. The 2009/10 Eden District drought damage was estimated at R300 million, the 2011 Eden District floods estimated at R350 million and the 2012 floods estimated at R500 million. The recent summer season of 2015/16 has seen a drought, and

¹⁷ These events are described by RADAR in the following report: <https://www.westerncape.gov.za/text/2013/July/radar-eng.pdf>. The costs are direct damage costs sustained and reported primarily by public sector entities, and are likely and underestimate of total costs from a range of storms and cut-off low pressure systems.

¹⁸ <http://www.riskreductionafrica.org/wp-content/uploads/2014/09/OFF-THE-RADAR-SYNTHESIS-REPORT.pdf> (this data was utilised, and non-cut off low pressure systems from the 2010 report added to this figure of R4.9 billion to reach a total of R 5 billion).

¹⁹ MEC Alan Winde, Cape Argus 4 February 2016.

dry conditions fuelling fires, that together are estimated to cost the agriculture sector up to R4 billion in losses. Tuesday March 3rd 2015 was the highest temperature ever recorded (in 100 years) in Cape Town at 42°C (this additionally coincided with severe fires). These disaster related damages place a significant financial burden on service delivery and the economy, without taking into account the indirect costs of social, environmental and other disruptive impacts that typically characterise such events. The impacts associated with the future climate projections for the region will result in an increasing economic burden, particularly if climate vulnerability is not reduced across the province.

Already a significant portion of the ecological infrastructure which should buffer against climate-related hazards, such as coastal barrier dunes, wetlands, and flood plains is compromised (see Biodiversity and Ecosystem Goods and Services). Increasing magnitude and frequency of extreme events, temperature increases, altered rainfall patterns and changes in evaporation rates, etc. will further compromise the ability of the natural environment to buffer human settlements and infrastructure against the impacts of climate hazards.

The possibility of increased disaster risk is considered to be one of the most concerning and potentially costly impacts of future climate change in South Africa and globally. Understanding these risks and identifying key areas of concern is critical for developing suitable and sustainable adaptation policies and scenarios. A consistent message from the Long Term Adaptation Scenarios analysis of drought-related risks over the medium and long term is that there will be increased water supply limitations in the Western Cape. The LTAS also indicated there will be an increase in amount of rainfall in the southern Cape likely resulting in high flood risk. Linking the potential increased flooding risk with the location of current key infrastructure shows the potential for 'high' or 'very high' impacts on the current flood design standards for more than 30% of bridges (road and rail), 19% of dams and 29% of ESKOM transmission line crossings across the country by mid-century²⁰.

BOX 2 2015/2016 DROUGHT INDUCED BY EL NINO

Many disaster events are not being attributed to a changing climate, even though we have already seen a global average increase of 1 Degree Celsius²¹. Furthermore, 90% of all disasters globally are now climate related, and the latest science points to the attribution of climate change being a driver behind many extreme weather events²². We need to formally recognise the economic costs and risks of climate related disasters as ones that will increase in magnitude and frequency.

As an example the current El Nino phenomenon, which is a naturally occurring one, is the worst on record, because it is occurring on top of an already 1 degree of warming. The oceans are much warmer than ever before and as a result the severity of the impacts of this 2015/16 El Nino has been substantial globally, including in South Africa, and the Western Cape.

In response to the El Nino and climate change driven drought, in February 2016 national government

[Continued on page 28 >](#)

²⁰Long Term Adaptation Scenarios Research Flagship Program, Technical Report No 3.

²¹This is already 2/3rds of what is considered the safe limits of warming that human communities and systems can withstand - this is seen as 1.5C of warming globally, and we have already surpassed the mark of 1C of warming.

²²National Academies of Sciences, Engineering and Medicine. 2016. Attribution of extreme Weather Events in the Context of Climate Change. Washington, DC: the National Academies Press. Doi: 10.17226/21852.

< Continued from page 27

allocated R450 million for drilling boreholes and improvement of water infrastructure and an additional R498 million had been further approved, in addition to R124 million allocated by provinces, to assist farmers with livestock feeds and water. This sum of up to R1 billion in reactive responses, which is less than the economic impact of the drought in the Western Cape alone (likely to be up to R2 billion), is a clear indicator of the economic cost of failure to adapt to climate change. Proactive planning and adaptive measures, rather than reactive measures, are likely to be less costly.

In addition to water supply challenges, the cost of basic food staples is a key consideration in responding to the current drought. Based on January 2016's preliminary retail prices, the cost of the staple basket increased by approximately 19% from January 2015 to the corresponding month in 2016 and a further increase of 10% in quarter 1 of 2016 is expected²³.

A similar drought situation was experienced in South Africa in 1992/3 (although the drought of 2015/16 is seen to be worse). In 1992/1993, undoubtedly one of the most widespread droughts of the last 45 years (until 2015/16), maize had to be imported to South Africa (as well as the rest of southern Africa). The knock-on effect of crop failure could be seen in the population drift from rural areas into the cities, farm labour lay-offs and farm closures as well as an increasing indebtedness in the agricultural sector (WeatherSA)²⁴. According to the Reserve Bank (Pretorius and Smal 1992) the loss of GDP during the 1992 drought was approximately 1.8 percent, representing US\$500 million which is a substantial impact from a sector playing a relatively small role in the economy (Mniki, 2009:34)²⁵. The drought of 2015/16 has already far surpassed these impacts.

Disasters, particularly drought, have a direct impact on the most vulnerable communities across the country. We can take the current disaster situation as a warning for the future and a timely reminder that the early climate change adapters will be the economic winners of the future.

To respond to disasters, and climate related disasters specifically, the South African national policy framework provides a robust basis from which to develop our responses. South Africa's legislation and policy instruments for disaster risk reduction, which includes early warning systems (EWSs) are one of the best in Africa, having adopted a proactive rather than a reactive approach²⁶. Both the Disaster Management Act (DMA) (RSA, 2002) and the National Disaster Management Framework (NDMF) (RSA, 23 2005) guide Disaster Risk Reduction Management (DRR-M) implementation in the country, with the National Disaster Management Centre being the lead institution for DRR-M. The newly promulgated Disaster Management Amendment Act (Act no. 16 of 2015) specifically refers to climate change adaptation, ecosystem-based adaptation and community based adaptation measures and investments being required by all tiers of government (National entities, provincial entities, and local entities). There is a strong risk reduction mandate contained in the National Disaster Management Act, and this should be included in provincial and district disaster management planning. This provides an opportunity to align infrastructure risk reduction measures with the provincial and district infrastructure frameworks and plans. The Act places the onus for rehabilitation and reconstruction of infrastructure on the organ of state responsible for maintaining such infrastructure (7.7.14 of National Disaster Management Framework).

²³Bureau for Food and Agricultural Policy: Policy brief on the 2015/2016 drought.

²⁴Long Term Adaptation Scenarios Research Flagship Program, Technical Report No 2.

²⁵Long Term Adaptation Scenarios Research Flagship Program, Technical Report No 2.

²⁶Long Term Adaptation Scenarios Research Flagship Program, Technical Report No 2.

BOX 3 SUCCESS IN PROACTIVE FIRE MANAGEMENT

Proactive approaches to managing veld fires are a good success story in the Western Cape, managed by the Chief Directorate: Disaster Management and Fire Brigade Services whereby part of the strategy is to rapidly deploy aerial support in the first hour of a fire ignition. This has resulted in a **success ratio of 97% of fire control in the first hour of a fire**. This is an outstanding figure, given that the few fires that have managed to persist have caused severe damage, indicating that these strategies are saving the Western Cape economy and its supporting natural resource base substantially. There is a veld fire plan that supports these strategies and showcases outstanding intergovernmental and multi-stakeholder collaboration required for managing climate change.

The National Disaster Management Centre (NDMC) promotes integration and coordination with a special emphasis on prevention and mitigation. It works with National, Provincial and Municipal organs of state, statutory functionaries, other role players and communities. The NDMC currently resides within the Department of Provincial and Local Government. The Western Cape Disaster Management advisory Forum is the key coordination forum for the province and meets quarterly, as well as an ad hoc basis as required in relation to disaster protocol. The WCG:DEA&DP Climate Change Directorate feeds into this forum in order to integrate and synergise on climate change and disaster management plans, programmes and activities. All District Municipalities in the Western Cape have Disaster Management Advisory Forums.

TABLE 3. RECENT WESTERN CAPE DISASTER MANAGEMENT TOOLS

Enhanced disaster management tools	Early Warning Database and Early Warning Systems (complete) GIS and web-based Decision Support Tool to guide district disaster management planning (complete) Provincial disaster risk and vulnerability assessment (2002) (complete) Provincial Risk Profile (under development)
------------------------------------	--

Western Cape Disaster Management (WCDM) ensures the maintenance of an early warning database that includes all the critical role-players within disaster management. The unit also disseminates warnings to all relevant stakeholders. This ensures that all the necessary line functions and department are kept abreast of all impending hazards. WCDM has well a maintained Geographic Information System and Web-based decision support tool which includes a large number of climate related hazard information. Most recently this has included a consolidation of all flood related data for the Western Cape; a roll out of the Decision Support Tool to all municipalities in the Western Cape and general maintenance and update of the datasets in its central data repository. A preliminary disaster risk and vulnerability assessment was undertaken in 2002 and forms the baseline for any subsequent disaster risk assessments by the Province. While these assessments take climate related hazards into account, the assessments fall short of a comprehensive assessment of climate change projections, the consequences for infrastructure and spatial planning, and need for disaster risk reduction measures.

MUNICIPAL RESPONSES

WCDM works closely with municipalities to strengthen the link between development and prevailing disaster risk including climate change. WCDM is in the process of ensuring all third generation IDPs include

a dedicated disaster management chapter. Furthermore in the past financial year updated risk profiles (of all disaster related risks including climate change) have been undertaken for Eden District, Central Karoo District and the West Coast District Municipalities which included the towns of Knysna, Beaufort West, Bergriver and Cederberg. All Districts now have updated risk profiles, and ten local municipalities have also been completed²⁷. This has assisted in high level planning and spatial mapping of the most prevalent hazards.

All Municipalities in the Western Cape have overarching Disaster Management Plans which cover climate change related risks to varying degrees. As these are updated they are becoming more uniform in approach. Now that the new Disaster Management Amendment Act (DMAA) provides more specific provisions for climate change adaptation specifically this area of work is likely to evolve substantially in the near future. In addition to Disaster Management Plans various municipalities have specific plans for some climate related hazards and could be utilised in future to further enhance planning²⁸.

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

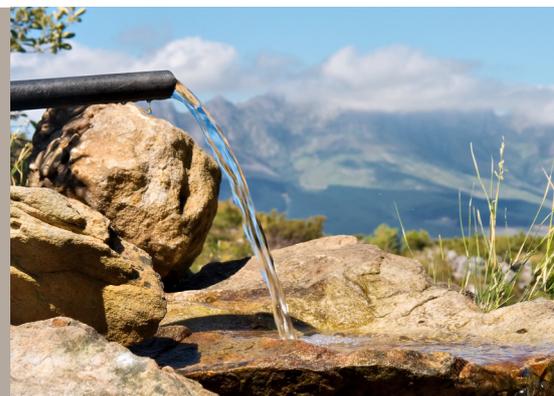
- Further refine requirements for appropriate climate change risk and vulnerability assessments in relation to ongoing disaster interventions, and as per the new Disaster Management Amendment Act provisions.
- Related to the above point, clearly determine which municipalities adequately include climate change in current Risk and Vulnerability Assessments in the province.
- Develop a coordinated reporting mechanism for the financial costs of climate related disasters in order to enhance analysis of the increasing economic and social impact across the province.
- Whilst many plans, policies and systems are in place for disaster management, the capacity at local and district level is limited, and it is highlighted that in a changing climate with an increasing intensity, severity and frequency of many climate related disasters that urgent attention to funding centres, and human resources must be elevated. Disaster management is a severely underfunded public service globally, and particularly in fiscally constrained environments such as in South Africa, and particularly at the local level this is a concern.
- Financing risk reduction remains a significant barrier to implementing identified climate risk reduction actions. Disaster damaged critical infrastructure is often just replaced in its previous form due to constraints such as lack of finance, Environmental Impact Assessment (EIA) demands, lack of specialist studies and the lack of appetite to do things differently and the need to quickly resolve the problem. Long lead times in transferring the Municipal Infrastructure Grant (MIG) results in the delay in the release of funds (between when a disaster occurs and when funds are released)²⁹. This is due to the conditions that need to be met before funding can be channelled from the national budget to the Department of Cooperative Governance (DoCG) and eventually to the MIG fund.

²⁷ These include: Beaufort West, Bitou, Knysna, George, Mossel Bay, Kannaland, Oudtshoorn, Saldanha, Bergrivier, and Cederberg.

²⁸ Information taken from the most recent Western Cape Disaster Management quarterly report - Q3 2015/16.

²⁹ Long Term Adaptation Scenarios Research Flagship Program, Technical Report No 2.

WATER



The current WCCCRS priority areas for addressing water security in the Western Cape in a changing climate include:

1. Invasive alien vegetation clearing;
2. Prioritisation, valuation, mapping, protection, and restoration of ecological infrastructure in catchments;
3. Effective utilisation of irrigation water;
4. Resource nexus decision support; and
5. Develop ecosystem goods and services (EGS) investment opportunities.

The current WCCCRS covers the following in this focus area, which is in addition to that coordinated under the Western Cape Sustainable Water Management Plan (WCSWMP) and activities of the Department of Water and Sanitation (DWS):

- i) Invasive alien vegetation clearing;
- ii) Effective utilisation of irrigation water; and
- iii) Ecosystems goods and services and ecological infrastructure (these are further covered in Biodiversity and Ecosystem Goods and Services).

TABLE 4. WATER INDICATORS FOR THE WCCCRS

HIGH LEVEL CATEGORY	INDICATOR	DATA
More Crop per Drop	Number of hectares registered for the FruitLook* Tool for broad scale management [indicating increasing water efficiency]	89 623 ha ³⁰
Alien Clearing	Number of hectares of IAP cleared per annum through Working for Water projects in Western Cape (represents 95% of clearing in the province)	85244 ha (2015/16) [Initial ha Cleared = 14865.2 Follow-Up ha Cleared = 70378.83]

*Fruitlook is discussed in additional detail in the food security, and invasive alien clearing sections of this report

TABLE 5. ADDITIONAL HIGH LEVEL WATER RELATED INDICATORS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Water	Total water supply versus total water demand [for the Western Cape Water Supply System, which supplies CCT and regions downstream of the Berg River]	Supply: 596,000,000.00 m ³ Demand: 508,100,000.00m ³ ³¹
Blue Drop score	Average Blue Drop score for the Western Cape	89% ³²
Green Drop score	Average Green Drop score for the Western Cape	84.5% ³³
Household Sanitation	% households with access to sanitation	94.8% ³⁴

³⁰89 823 ha (45 963 ha for 2015/16 and 43 860ha historic) is registered for broad scale management utilising the tool as of 30 April 2016. Of this 41 023 ha is registered for farm scale management. The area for which FruitLook data can be obtained on a weekly basis is 170 000 ha. Data obtained from WC DoA.

³¹ Western Cape Government Green Economy Report 2014 [2013 data].

³² Western Cape Government Green Economy Report 2014 [2013 data].

³³ Western Cape Government Green Economy Report 2014 [2013 data].

³⁴ Western Cape Government Green Economy Report 2014 [2013 data].

The Long Term Adaptation Scenarios for South Africa - brief on Water, states unequivocally that 'Climate change impacts on South Africa are likely to be felt primarily via effects on water resources; significant trade-offs are likely to occur between developmental aspirations ... with significant social, economic and ecological consequences through restricting the range of viable national development pathways.' The State of Environment Outlook Report (SOEOR) (Annex 3) for the Western Cape indicates a general baseline decline in water quantity and quality, that invasive alien species are further adding to the limitations on water supply and that land use practices that are degrading ecosystems, and increasing sediment loads and run-off are further negatively impacting on water resources. Many urban areas and regions in the Western Cape face water stress already, and the ecosystems which provide and produce the water resource are increasingly under threat. In most cases, climate change will increase this pressure through increased temperature and evaporation, likely reductions in rainfall, drying, and related increases in extreme weather events which will negatively impact critical infrastructure systems. Blue drop, green drop and access to sanitation scores indicate that very small proportions of the Western Cape have underlying vulnerability related to access to potable water and adequate sanitation, however, these can easily decline with eroding infrastructure (Table 5).

From Table 6 below it can be determined that despite the increase in water supply between 2000 and 2005, there are insufficient water resources available to meet the current demands for the Province. All Water Management Areas (WMAs), except the Breede, are recorded with a negative water balance as a result of overutilization³⁵. This often correlates with the ecological condition of the fresh water systems being degraded. As a result, the WMA's are severely stressed and vulnerable to any major changes in rainfall e.g. from drought and long term climate change.

TABLE 6. A COMPARISON OF THE OVERALL WATER RESOURCE SUPPLY AND CONSUMPTION BETWEEN 2000 AND 2005, PER WATER MANAGEMENT AREA³⁶

WMAS	YEAR: 2000 (MILLION M ³ PER ANNUM)			YEAR: 2005 (MILLION M ³ PER ANNUM)		
	WATER SUPPLY	WATER USE	BALANCE	WATER SUPPLY	WATER USE	BALANCE
Berg	676	704	-28	709	745	-36
Breede	865	828	37	1090	1071	19
Gouritz	275	339	-64	351	415	-64
Olifants / Doorn	338	373	-35	372	406	-34
Provincial Total			-90			-115

In the Western Cape, irrigation to support agriculture is the major water use in the four currently designated water management areas (WMAs), as shown in Table 6. In the Berg WMA however, water supply service to the metropolitan area of Cape Town also represents a major source of consumption³⁷. As a result of the importance of the Berg River in the province, a number of strategic projects have been initiated under

³⁵ Western Cape State of Environment Outlook Report 2013.

³⁶ Annual Report on the Western Cape Sustainable Water Resource Management Plan 2014/15.

³⁷ GreenCape Water Market Intelligence Report, 2015.

the 'Berg River Improvement Plan (BRIP)' (Box 4). One of the key project priorities in the BRIP project is rehabilitation of river banks cleared of invasive alien vegetation. In addition, numerous other partner organisations are conducting invasive alien clearing in priority catchment areas throughout the province. The data on this will over time be reported on as an indicator of expenditure on ecosystem maintenance for water security.

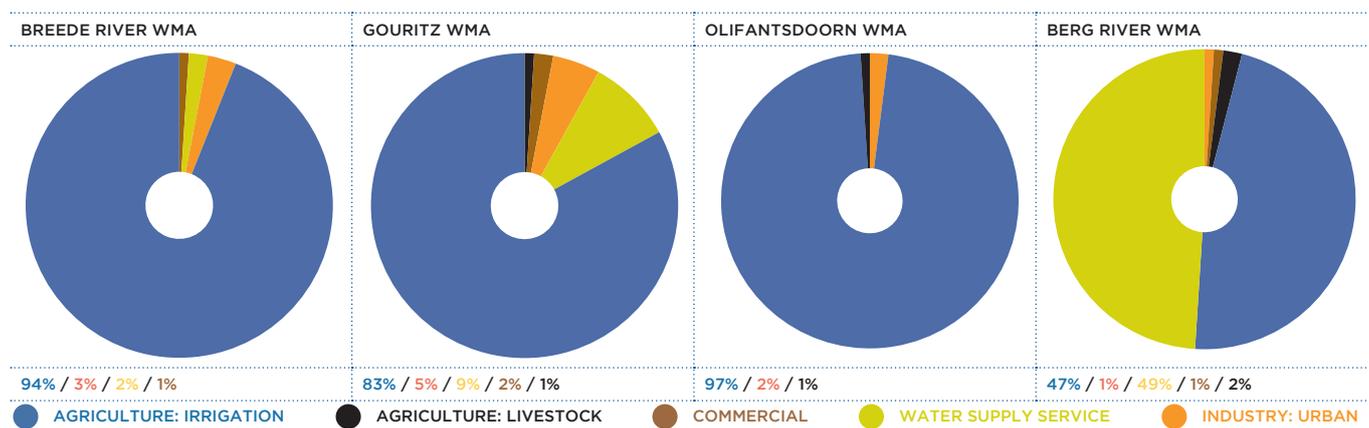


FIGURE 6. Registered water use per WMA - Western Cape Areas³⁸

TheWCG:DEA&DPs: Pollution and Chemicals Management are undertaking work on a number of specific projects to improve water quality, under the guidance of the Western Cape Sustainable Water Management Plan (2012). One of these areas of work is the development of guidelines for River Maintenance and Management Plans (RMMP) as a key mechanism for improving management of rivers. An application checklist for compiling a RMMP has been developed and is currently available for use by applicants.

BOX 4 BERG RIVER IMPROVEMENT PLAN³⁹

The Berg River contributes significantly to agriculture in the Western Cape. The value of the market based on agricultural surveys in **the Berg River area and linked to market sales figures is over R3 billion (with over 80% destined for export)**. It is essential that the water quality in the Berg River comply with the appropriate standard - this is important for maintaining the rand value of both the local and export market. As part of implementing the Water Plan, a Berg River Improvement Plan was endorsed by the Western Cape Government during January 2013 (DEA&DP 2012b). Under this plan, short and long-term actions are currently being implemented and integrated across the various departments of the Western Cape Government towards a common outcome, viz. a Water Stewardship Programme for the Berg River that facilitates the recognition of the Berg River for its value for ecosystem services, and its natural resource state as it relates to water quality and quantity returns, while promoting sustainable growth and development in a green economy. Improvements are prioritised into a series of tasks which include riparian zone rehabilitation, bioremediation, water quality monitoring and associated economic analysis. These efforts have been further enriched through river stewardship and successful propagation at the on-site nursery.

It is the responsibility of the Department of Water and Sanitation (DWS) to respond to expected growth initiatives to provide guidance on water sources and supply. DWS is also responsible for bulk water

³⁸ GreenCape Water Market Intelligence Report, 2015.

³⁹ Annual Report on the Western Cape Sustainable Water Resource Management Plan 2014/15.

planning with ensuring, that the necessary water is available when it is required. Catchment Management Agencies are being established as inter-governmental and multi-user coordination bodies that oversee the maintenance of catchments that ultimately provide water. Distribution of the water resource at the local level is the responsibility of the municipality. Municipalities and particularly the City of Cape Town (as one of the largest water users in the province) thus have a key role in water management.

In order to devolve responsibility of water resources to a more local level, Catchment Management Agencies are to be established by the DWS (National Water Act of 1998). The Breede-Gouritz Catchment Management Agency (BGCMA) was formally established as a CMA in May 2014; the Berg-Olifants Catchment Management Agency (CMA) is currently a proto-CMA, being administered by the DWS.

In early 2005, the then Department of Water Affairs and Forestry (DWAF), as the custodian of the country's water resources, in partnership with the City of Cape Town (CCT), commissioned the Western Cape Reconciliation Strategy Study to facilitate the reconciliation of predicted future water requirements with supply available from the Western Cape Water Supply System (WCWSS) for a 25-year planning horizon. The Strategy is used as a decision-support framework for making timeous and informed recommendations on those interventions that should be implemented to meet the future water requirements. The Planning scenario used in this study, however, does not include climate change as the uncertainty of the impacts on rainfall is deemed too high for planning in the short term.

Currently the WCWSS Reconciliation Strategy identifies the following key targets⁴⁰:

1. CCT must reduce water losses to less than 15% of total average demand;
2. Ensure on-going effective management and implementation of integrated water resources planning (WRP);
3. Mobilise resourcing according to the Water Conservation / Water Demand Management (WC/WDM) Strategy;
4. CCT must by 2020, reduce and maintain non-revenue water to below 20% of the total average annual water requirement and within accepted international benchmarks; and
5. Reduce projected potable requirement to an average growth rate of no more than 2% per annum for the next 10 years and conserve Cape Town's available water resources.

In the latest status Report – goals one and four above were achieved in the 2012-2013 financial year. Non-revenue water (NRW) was reduced to 19.8% and water losses were contained below the 15% target. In addition the CCT was able to sustain growth in water requirements below the 2% target despite a population increase. In other words the CCT and its water users are managing to decouple economic / population growth from water use which is a substantial achievement.

⁴⁰GreenCape Water Market Intelligence Report, 2015.

On the supply side, developments within water infrastructure in the Western Cape include the start of work to increase the capacity of the Clanwilliam Dam. In addition, there is growing interest in desalination, with the Cederberg and Mossel Bay municipalities having already invested in this technology.

The water sector is critical for climate change adaptation. DWS through the National Water Act has recognised the importance of the maintenance of the ecological infrastructure and an ecological reserve is actively set aside for this purpose and that the protection of important areas is recognised through appropriate Water Resource Quality Objectives and the identification of National Freshwater Priority Areas - NFEPA's (NFEPA 2011). A primary concern for managing water into the future is to protect the very sources of where it is produced, and thus to maintain ecosystems – rivers and wetlands – and their surrounding water catchments. Freshwater Ecosystem Priority Areas (FEPAs) describe the “strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources” (Nel et al. 2011) and are one of the emerging tools for protecting freshwater ecosystems. The maintenance of supportive ecological infrastructure such as wetlands and healthy riparian zones is highly dependent on sound land management which is supported by Agriculture under the Conservation of Agricultural Resources Act (CARA) regulations and should also be built into Area Wide Planning Processes and the establishment of River Management Maintenance Plans, as set out in the National Environmental Management Act (NEMA) regulations. These issues further emerged out of the SmartAgri project as priority climate change response priorities (see Food Security).

MUNICIPAL RESPONSES/ANNUAL TRENDS IN NON-REVENUE WATER LOSSES

At the Municipal level, municipalities have ‘Municipal Water Services Strategies and Plans which include mechanisms such as water metering, by-laws and stepped tariff structure. As these get updated they might include increasing consideration of climate change. Currently many are dealing with increasing conservation and demand side management of water which as a key priority for all water users. Protection of water resources from pollution is also an effort to protect our dwindling resource, but non-revenue water⁴¹ losses constitute significant losses even before reaching the consumer. The DWS, through bilateral engagements (among other) with local municipalities, have affected a monitoring system to determine which municipalities are adversely affected by such losses. Only 7 out of the 24 municipalities (including the City of Cape Town) who submitted their water balance information achieved a decrease in the value of their Non-Revenue Water from 2013 to 2014⁴² It is clear that the most benefit from reduction in NRW will come from efforts in the metropolitan area and as a result this is a major focus for many institutions engaged in water security planning.

⁴¹ Non-revenue water includes free basic water and water to communities that do not pay for the water. Water losses are included under non-revenue water but it is a subset of this category.

⁴² Annual Report on the Western Cape Sustainable Water Resource Management Plan 2014/15.

BOX 5 TRENDS IN DECOUPLING OF WATER DEMAND AND ECONOMIC/POPULATION GROWTH IN THE CITY OF CAPE TOWN

The City of Cape Town (one of the largest water users next to agriculture in the province) has seen negative growth of its water requirements for three years until 2013/14, despite the population increase. The non-revenue water was cut down to 21.8%, while the water losses were contained below the target of 15%, in 2013/14. The total savings of the domestic and industrial sector was 74 million m³ in 2013/14, measured against the water requirement scenario from the original Reconciliation Strategy (DWAF, 2007). However, this achievement could not be maintained for the 2014/15 municipal year, partly due to the steep increase in water consumption by the CCT and due to additional urban and industrial users that were not accounted for in the previous reporting.

Taken from Western Cape Water Supply System Reconciliation Strategy
-Status Report, October 2015

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

- Update the Sustainable Water Plan with new climate change related information and plans in its review in 2017/18 based on the Policy Alignment review and discussions between WCG:EADP, WCG: Agriculture, SmartAgri etc.
- Review the Specifications of the Regional Bulk Infrastructure Grant (RBIG), Municipal Infrastructure Grant (MIG), Accelerated Community Infrastructure Programmes (ACIP) and other similar funds and allocations to determine their climate responsive state (and link to any other ongoing such initiatives).
- Protection of Strategic Water Source Areas (SWSAs) (previously termed High Water Yield Areas - these areas which are mostly in the mountains cover 8% of the countries surface area but produce 50% of the water) should be a strategic climate protection priority for the Western Cape. SWSAs should be evaluated to ensure they receive appropriate protection in terms of supportive zoning in SDFs (Spatial Development Frameworks).
- It is recommended that ground water monitoring needs to become a growing priority in the Western Cape.
- Whilst coordination of clearing and rehabilitation has become more streamlined and effective in recent years, further cooperation between IAP clearing authorities and rehabilitation programmes for wetlands and rivers will be beneficial in a changing climate. Currently there is no centralised reporting mechanism and spatial capturing of initiatives.
- Continued focus on the way in which we manage our water systems, and increased emphasis on Water Sensitive Urban Design.

FOOD SECURITY



The current priority areas for addressing food security and an economically sustainable agricultural industry in the Western Cape in a changing climate include:

Priority areas:

1. Farming practices that are in harmony with nature, i.e. 'conservation farming';
2. Climate smart agriculture;
3. Agricultural water technologies that reduce consumption and increase efficiency (see Water);
4. Research on climate resilient and alternative crops and livestock applicable to the Western Cape;
5. Addressing climate vulnerability through the Municipal Support Programme; and
6. Assessing food security in the context of the resource nexus.

The current WCCCRS covers the following in this focus area, which will be expanded upon in the next WCCCRS as a result of the development of the 'Smart Agriculture for Climate Resilience -SmartAgri' strategy:

- i) The promotion of climate smart agriculture;
- ii) Promoting food security at the municipal level; and
- iii) Research on climate resilient and alternative crops and livestock applicable to the Western Cape.

TABLE 7. FOOD SECURITY INDICATORS FOR THE WCCCRS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Sector climate change strategy	'Smart Agriculture for Climate Resilience' Strategy [SmartAgri] developed and implemented.	Strategy and Implementation Framework published May 2016 and implemented from 2016/17 financial year.
More Crop per Drop	Number of hectares users utilise by the FruitLook Tool [indicating increasing water efficiency]	15 608 hectares for the 2014/15 season ⁴³
Climate Science backed decision-making	Identification of historical climate trends and projections for future climate in the WC.	SmartAgri Status Quo Assessment report 2014
SmartAgri Research Agenda	Identification of key research areas for stimulating and facilitating shift to climate smart agriculture	Developed under SmartAgri project, sent to Cape Higher Education Consortium (CHEC).

TABLE 8. ADDITIONAL HIGH LEVEL FOOD SECURITY INDICATORS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Land	Agricultural land improved through conservation measures annually	29,076.00 ha ⁴⁴
Household Food Security	% households with measure of food insecurity	22.70% ⁴⁵

⁴³Smart Agri Case Study: FruitLook(2016): <http://www.greenagri.org.za/assets/documents-/SmartAgri/Case-Studies/1.-Case-Study-FruitLook-FINAL.pdf>

⁴⁴Western Cape Government Green Economy Report 2015 [2014 Data].

⁴⁵Western Cape Government Green Economy Report 2015 [2014 Data].

The agricultural sector is an important backbone of the economy of the Western Cape; it is further, pivotal for food security, and yet is, by nature, highly sensitive to climatic changes. The sector is also the single largest user of water in the province. The Western Cape has already experienced gradual warming of approximately 1°C over the last five decades. The region is expected to be particularly hard hit by the combination of warming and additional stress on already constrained water supplies. Without an adequate and timely response, climate change could constrain the future development and sustainability of the agricultural sector and threaten economic growth, jobs, livelihoods and food security.

Farmland constitutes 89% of the total land in the province, and generates approximately R39 billion gross production value. The Western Cape has the highest market value of agricultural assets in South Africa at R44 billion and also the largest farming debt at R9.6 billion. The province contributes 45% of national agricultural exports, and steady increases in exports of wine, fruit and livestock products have contributed positively to economic growth and rural incomes. The agricultural sector employs approximately 150 000 people in the Western Cape, and has strong forward linkages to the manufacturing sector in the form of food and beverage processing. There are also strong backward linkages to input suppliers such as feed, equipment, fertiliser and packaging companies. These industries contribute significantly to employment in the province. It is estimated that the production sector contributes 71.6% to employment in the agri-processing value chain.

In addition to the climate change threats to agriculture, there are additional underlying vulnerabilities as highlighted in the SOEOR (Annex 3) which indicate a general declining environment (including water, ecosystems and land transformation) which render the agriculture sector even more vulnerable to climate change. Various baseline activities are underway such as LandCare programmes to improve agricultural land. Almost all the adaptive responses which are already being implemented in the province are driven primarily by non-climatic drivers, particularly economic drivers (both on-farm and consumer-driven), and in some instances the need for greater ecological and social sustainability⁴⁶. Farmers and agri-businesses adopt new ways of doing things only where it makes economic sense and/or the market demands it. However, future climate resilience is often acknowledged as a co-benefit. Good examples of 'no-regrets' approaches providing multiple benefits are Conservation Agriculture and the FruitLook Project. Interventions are now required that additionally respond directly to climate change threats on top of business as usual responses, which is where the SmartAgri Strategy is pivotal in redirecting the whole sector.

Globally, greenhouse gas (GHG) emissions from agriculture, forestry and other land use are steadily increasing. They now stand at just under a quarter of global emissions, and future emissions may further increase by up to 30% by 2050. In the agricultural sector there is some potential for mitigation through an enhancement of GHG removals and emission reductions through management of land and livestock and demand-side

⁴⁶SmartAgri Status Quo Summary report.

management. Despite the high global emissions, the agricultural sector accounts for only 2% of energy consumption in the province. The land sub-sector within the Agriculture, Forestry and Other Land-use sector is accountable for 5% of national GHG emissions (this excludes the carbon sequestered by landscapes). The agriculture sector of the Western Cape accounts for 5% of the province's total emissions. Estimates suggest that the livestock sub-sector is accountable for approximately 16% of provincial agricultural GHG emissions (highest contribution from cattle), grains and field crops for 28% (highest contribution from wheat), fruit and wine for 55% (highest contributions from pome fruit and wine grapes) and other commodities for 1% (see Energy).

In the Western Cape, the agricultural system has proven its resilience to a certain degree, and is already relatively well adapted to existing climate variability. Recent disruptions and climate-related disasters such as the 2009 drought and the 2015/16 drought could indicate this trend may be shifting. Similar systems in other parts of the world such as California and South Western Australia have recently had significant negative impacts on agriculture as a result of a changing climate.

To respond to climate change in the Agriculture sector the Western Cape has developed an innovative climate change resilience strategy called "SmartAgri", see Box 6. This strategy builds on all the existing initiatives that are contributing to resilience and low carbon management of systems, such as LandCare, Fruitlook, Conservation Farming and Green Economy initiatives. Climate Smart Agriculture takes a systems approach to securing sustainability and resilience by addressing both adaptation and mitigation in agriculture while providing economic, ecological and social benefits.

Additional supporting policies and initiatives also aim to progress climate responses to a certain degree, such as through the WC Green Economy Strategy Framework (2013).

BOX 6 SMARTAGRI

SmartAgri - 'Smart Agriculture for Climate Resilience' is a sector climate change response plan developed in partnership between the Western Cape Government: Agriculture (DoA) and the Western Cape Government: Environmental Affairs & Development Planning (WCG: EA&DP)⁴⁷. It is a framework and implementation plan developed over 20 months to provide a comprehensive Status Quo Assessment of the Agriculture sector in the Western Cape, which covers: i) existing climate change impacts and early responses by agriculture to adapt to climatic changes; ii) climate trends and risk and vulnerability assessments of each region of the Western Cape, and its commodities to climate change impacts and iii) synergistic low carbon responses in the Agriculture Sector. Extensive consultation has taken place across the province, with farmers, commodity groups, support sectors, municipalities, districts, and a variety of provincial and national government departments, to develop a Climate Change Response Framework for the Agriculture Sector of the Western Cape Province (WCCCARF). This will lead to implementation and mainstreaming of climate change into agricultural planning and fiscus from 2016. The sector plan builds on a wide range of already existing activities that are decreasing vulnerability and risk across various commodity groups in the province, including *inter alia*: Fruitlook, LandCare, Fire Protection Associations, promotion of Conservation Agriculture, increased water efficiency.

Continued on page 40 >

⁴⁷<http://www.greenagri.org.za/smartagri-2/about/>

The Status Quo Review makes the following findings:

- In recent years there has been a great effort to incorporate climate change into National, Provincial and Local Government Policy.
- The fundamental unpredictability of the biophysical and socio-economic environment has forced policy makers to look for ways to use policy to boost resilience, through aligning policy between tiers of government.
- This is also pursued through the formation of new partnerships beyond government with business, the private sector, academic institutions and civil society organisations.
- Despite these efforts, further policy alignment is needed, as well as further clarification of national versus provincial mandates.

PROMOTING CLIMATE SMART AGRICULTURE

Climate-smart agriculture is one of the primary responses initially being pursued and is also highlighted as a priority in SmartAgri. This approach includes improved soil management techniques, minimising carbon release and maximising carbon sequestration; rehabilitation of ecological infrastructure will also enhance sequestration. Climate smart agriculture further focusses on climate adaptation by building farmers' climate resilience, as well as improving livelihoods through poverty reduction. Programmes such as Landcare and ongoing extension support services will continue to promote climate smart agriculture practices. Programmes such as FruitLook additionally support farmers' ability to increase water-use efficiency without compromising production, and is an example of the leading role that is already being played by the sector in climate change adaptation. The FruitLook programme has had an uptake by many farmers to improve their water efficiency and the tool now covers 15,468 hectares.

PROMOTING FOOD SECURITY AT THE MUNICIPAL LEVEL

Urban and peri-urban agriculture is part of the overall food system, although participation rates by poor households in Cape Town (5% in 2007) and in the province (2%) are very low. However, the Philippi Horticultural Area of Cape Town makes a very important contribution to the supply of fresh vegetables to the city's supermarkets. Other urban production areas such as the Joostenbergvlakte contribute to the chicken and pork supply. More recently a Food Security and Nutrition Strategy for the Province was commissioned and particularly prioritises urban food security issues.

RESEARCH ON CLIMATE RESILIENT AND ALTERNATIVE CROPS AND LIVESTOCK APPLICABLE TO THE WESTERN CAPE

The Western Cape can draw on its very strong research and knowledge base on natural resources to devise strategies that strengthen the linkages with agriculture and its productive potential into the future. This will require a targeted focus on better understanding and monitoring such linkages, and improved collaboration between the agriculture, water and biodiversity sectors. The private sector has taken the lead in providing research support, with some areas of research covered

by the WCG: Agriculture. An extensive spectrum of research gaps and priorities has systematically been identified through the development of the SmartAgri project and the current list has been shared through the Cape Higher Education Consortium (CHEC). The list will also be shared with other research organisations and commodity groups to incorporate into their respective research programmes.

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

- The current potential to respond is hampered by the limited availability and additionally the loss of institutional and human capacity (and institutional memory) in critical areas in government. Research capacity and expertise at municipal decision-making level is limited and collaboration and co-operation is lacking.
- This review has found that, although the agricultural value chain is known to be extremely important in the Western Cape, limited work has been done to assess the impacts of climate change across the value chain. Growth opportunities in the value chain should be well assessed against climate change risks and impacts, including the question of limiting resources (water, energy) required for these activities.
- Focus should be on promotion of carbon sequestration through land-based interventions such as restoration of rangelands, reducing degradation of soils and land cover and promoting conservation agriculture (with partners).
- Continue to promote reduction of energy consumption and switch to renewable and energy efficiency where feasible.
- Transition from measuring carbon footprints to reducing them with appropriate policy support.
- Increased collaboration between agriculture and health with regards to occupational climate change risks of agricultural workers.
- A more integrated approach between agriculture and food security is needed.
- The following have been identified through the SmartAgri project as priority programmes, and these are likely to be an immediate focus from 2016 onwards:
 - o Conservation Agriculture for all commodities and farming systems
 - o Restored ecological infrastructure for increased landscape productivity, socio-ecological resilience and soil carbon sequestration
 - o Collaborative integrated catchment management for water yield and quality and job creation
 - o Climate-smart energy case studies are needed to inspire the transition to low-carbon agriculture
 - o Climate-proofing the growth of agri-processing in the Western Cape
 - o Integrated knowledge system for climate-smart agricultural extension



ENERGY

The Energy Chapter covers the Renewable Energy, as well as the Energy Efficiency and Demand Side Management focus areas. Transport has a strong link to the energy chapter, particularly in terms of the emissions associated with the use of transport fuels, such as petrol and diesel. The role of transport as part of the total energy and emissions profile is discussed here, but the detail around responses for that sector are addressed in the Sustainable Transport chapter.

The current priority areas for addressing (energy efficiency and renewable energy) in the Western Cape in a changing climate include:

1. Implementation of building energy efficiency programmes and awareness raising, including improved energy efficiency of WCGs own building stock;
2. Promotion and rollout of solar water heaters (both low and high pressure systems);
3. Development of the renewable energy economy in the Western Cape, in terms of both the appropriate placement of utility scale renewable energy generation as well as manufacturing opportunities;
4. Development of waste-to-energy opportunities for both municipal and private (commercial and industrial) waste systems⁴⁸; and
5. Development of opportunities around small-scale embedded generation.

TABLE 9. ENERGY INDICATORS FOR THE WCCCRS

HIGH LEVEL CATEGORY	INDICATOR	DATA
GHG emissions	GHG emissions associated with the energy sector	36 345 753 tCO _{2e} (2012) ⁴⁹
Energy Consumption in the Western Cape	Energy Consumption (total)	276 333 250 GJ (2012) ⁵⁰
	Sector Breakdown	
	Industry	85 383 982 GJ
	Transport	146 296 370 GJ
	Agriculture	6 968 221 GJ
	Commercial	10 921 301 GJ
Local Government	2 111 886 GJ	
Residential	24 652 305 GJ	
Solar Water Heaters (SWHs)	Number of SWHs installed in the Western Cape	14 889 HP SWH ⁵¹
Renewable energy	Total energy produced from Renewable sources by independent power producers	421.82 MW ⁵²
	Annual values of renewable energy projects financed by national and international funding sources	R 8 024 mill ⁵³
Small Scale Embedded Generation	Number of Western Cape municipalities that have implemented SSEG tariffs	4

⁴⁸The waste-to-energy priority programme is discussed in the Waste Minimisation and Management focus area chapter.

⁴⁹Western Cape Energy Consumption and CO₂ emissions database report (2015).

⁵⁰Western Cape Energy Consumption and CO₂ emissions database report (2015).

⁵¹GreenCape Market Intelligence Report 2014.

⁵²Green Economy indicator report 2015.

⁵³Green Economy indicator report 2015.

GHG EMISSIONS ASSOCIATED WITH THE ENERGY SECTOR

The National GHG Inventory (2000 – 2010) attributes 85% of national GHG emissions to the energy sector⁵⁴. The proportional breakdown for the Western Cape is not available.

The WCG has concluded two energy consumption and CO₂ emissions data collection exercises in order to understand and track the emissions profile for the energy sector in the Western Cape. These were undertaken in 2012 (based on 2009 data) and in 2015 (based on 2012 data). Table 10 highlights the key indicators for the energy sector emissions profile. The major finding has been the drop in the total energy consumption and the associated emissions. There are a number of reasons for this drop, including the impacts of the economic down-turn in the country, behaviour change as a result of increasing electricity prices, and the increased uptake of energy efficiency interventions and renewable energy for residential, commercial and industrial users. Noteworthy is that emissions per capita and GDP have also dropped, which may show some early indications of a decoupling of energy consumption from economic growth.

TABLE 10. SUSTAINABLE ENERGY INDICATORS FOR THE WESTERN CAPE

KEY SUSTAINABLE ENERGY INDICATOR	UNIT OF MEASURE	PROVINCIAL VALUE (2009)	PROVINCIAL VALUE 2012/13
Total Energy consumption	GJ	292 342 004	276 333 250
Total energy related GHG emissions	tCO _{2e}	38 532 296	36 345 753
Energy consumption per capita	GJ/capita	64	46
GHG emissions per capita	tCO _{2e} /capita	8	6
Energy per GDP (R' mill)	GJ/GDP	1 428	679
GHG emissions per GDP (R' mill)	tCO _{2e} /GDP	178	89

Figure 7 shows the CO₂ emissions by sector and fuel type for both 2009 and 2012/13. The largest proportion of the energy consumed in the province is the transport sector with 53%, followed by industry at 31%. Across the province the residential sector is only responsible for 9% of energy consumption. This highlights that most of the energy efficiency activities should take place in the industrial and transport sectors, although many of the interventions for the residential and commercial sectors are generally considered “low-hanging fruits.”

It is industry, however, and not the transport sector that contributes the most to the provincial emissions profile at 38% as it draws from coal-derived electricity as well as fairly large amount of direct coal consumption. This is followed by the transport sector. The 2012 and 2009 emission proportional breakdowns are very similar showing not many changes between sectors. Electricity is responsible for most of the emissions at 61% (up from 55% in 2009). This is followed by the liquid fuels, predominantly linked to the transport sector (petrol and diesel). Electricity is the largest producers of emissions in the Western Cape due to the coal-based electricity linked to the national grid. Electricity’s contribution to emissions should decrease over time with the increase

⁵⁴The National GHG Inventory emissions proportions are: Energy (85%), Waste (5%), IPPU (5%) and AFOLU (5%) – making up 95% of total GHG emissions for the country.

in energy efficiency, embedded generation and renewable energy's contribution to the national energy mix. This trend should also manifest in primary coal for industry purposes and liquid for transport as efficiencies in these sectors increase, and as fuel switching opportunities such as Liquefied Natural Gas (LNG) arise. This clearly highlights the sectors that need to be targeted in order to reduce emissions in the Western Cape.

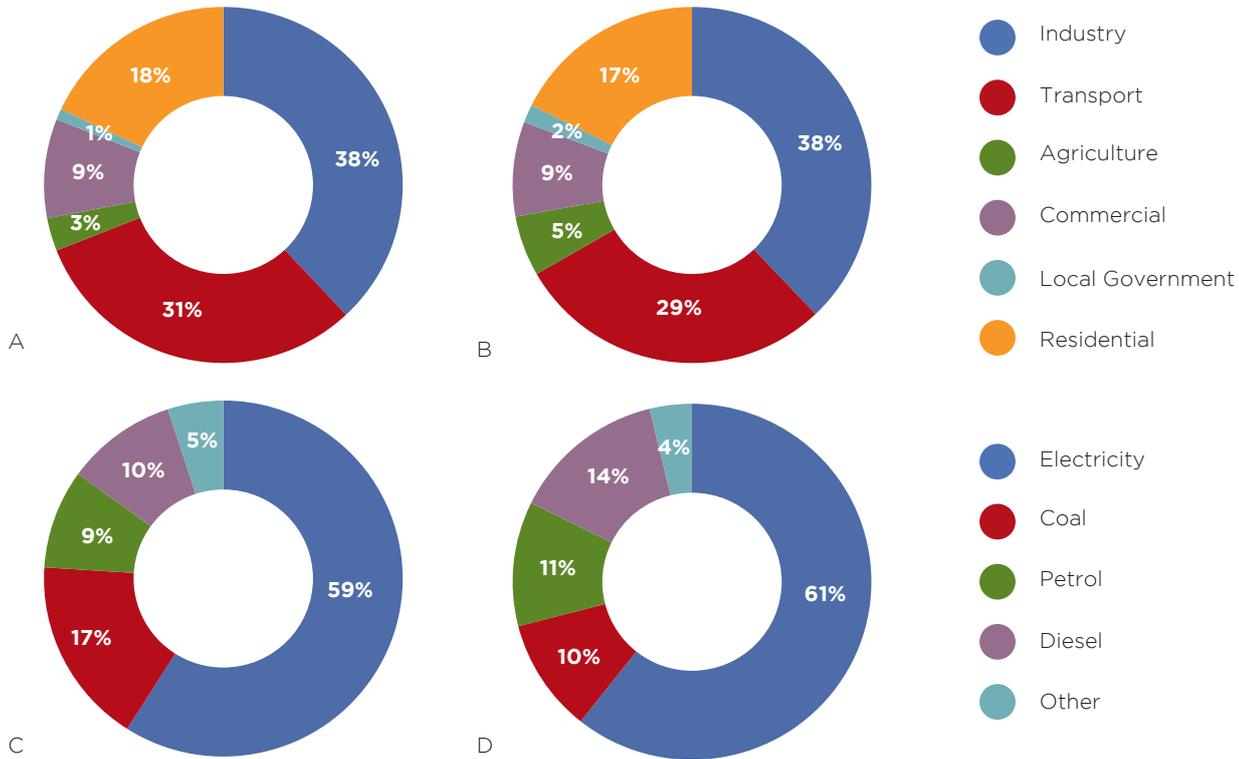


FIGURE 7. CO₂ emissions from energy use by sector and fuel type for 2009 and 2012/13 (a. Emissions by Sector for Western Cape (CO_{2e}) (2009); b. Emissions by Sector (CO_{2e}) (2012/13); c. Emissions by Fuel for Western Cape (CO_{2e}) (2009); d. Emissions by fuel (CO_{2e}) (2012/13)

The Climate Change Mitigation Scenarios for the Energy Sector study (2015) has highlighted a number of mitigation measures for the energy sector, based on the national Mitigation Potential Analysis, in order to reduce the emissions associated with energy use in key sectors.

This exercise identified 100 supply and demand side mitigation measures for the energy sector and then modelled a set of scenarios around the uptake of these mitigation measures. The analysis reflects that the largest gains in terms of mitigation resides in the power generation, where the measures are associated with replacing coal-fired power plants with renewable energy plants and natural gas fired plants.

The models then allowed emission projections to be made for two core climate mitigation scenarios:

1. All Possible Measures (APM); and
2. APM with the addition of fuel switching from coal and liquid fuels to natural gas.

The study also identified measures over which the Province and municipalities within the Province have influence, with the associated ability of these organisations to influence emission reductions.

One of the approaches for selecting mitigation measures is to identify those with the greatest emissions abatement potential. Under such a view, the mitigation measures which rank in the Top 20 (shown in Table 9) include energy supply-side, transport, buildings and selected industry measures. The Top 20 mitigation measures ranked by emissions abatement alone have the potential to result in a reduction of emissions by 68% relative to the Reference Case.

TABLE 11. MULTI-CRITERIA ANALYSIS RANK BY EMISSIONS ABATEMENT TOP 20 MITIGATION MEASURES

RANK	SECTOR	SUB-SECTOR	MITIGATION MEASURES	OVERALL WEIGHTED MCA SCORE	TOTAL EMISSIONS ABATED (ktCO _{2EQ})	% OF TOTAL EMISSIONS ABATED
1	Electricity	Electricity	Onshore wind	57.27	39 914	8%
2	Transport	Road	Road - Shifting passengers from cars to public transport	68.44	29 701	6%
3	Electricity	Electricity	Solar Photovoltaics (concentrated)	63.97	29 069	6%
4	Electricity	Electricity	Natural Gas Combined Cycle Gas Turbine (CCGT)	66.33	26 450	6%
5	Transport	Road	Improved efficiency - petrol and diesel Internal Combustion Engine (ICE)	58.22	21 054	4%
6	Electricity	Electricity	Concentrated Solar Power (Parabolic trough)	57.65	19 660	4%
7	Industry	All remaining Industries	Energy efficient boiler systems and kilns	58.53	15 477	3%
8	Buildings	Commercial	Efficient Lighting	62.01	14 932	3%
9	Transport	Freight	More efficient engines	55.40	13 503	3%
10	Electricity	Electricity	Solid waste related energy	57.53	13 385	3%
11	Buildings	Commercial	Heating Ventilations and Air Conditioning (HVAC) improvements (incl Heat pumps)	56.76	11 085	2%
12	Industry	All remaining industries	Fuel Switch	49.15	10 357	2%
13	Agriculture	Agriculture	EE in pumped irrigations: Variable Speed Drives (VSDs)	50.42	10 356	2%
14	Electricity	Electricity	Biomass	63.36	10 224	2%
15	Industry	Paper and pulp	Convert fuel from coal to biomass/ residual wood waste	61.23	10 111	2%
16	Transport	Road	Alternative fuels - Petrol and diesel hybrids	59.54	9 633	2%
17	Buildings	Commercial	Passive buildings/improved thermal design - New Buildings	50.02	9 377	2%
18	Buildings	Residential	Solar water heating	63.50	9 004	2%
19	Agriculture	Agriculture	EE in on-farm cooling	58.31	8 851	2%
20	Industry	Iron & Steel	Fuel Switch	59.41	8 267	2%

ENERGY EFFICIENCY

Energy efficiency in both the public and private sector has strongly increased over the last few years and there are a number of successful case studies that have been shared in the sector.

This indicator is strongly focussed on public buildings, but private sector programmes will also be discussed. In the WCG an annual property efficiency report (4th report reported on 2014/15) has been developed to review the WCG office estate. This report includes a chapter on the environmental performance of buildings, with a focus on energy and water management. As part of the modernisation of the WCG office space, there has been a focus on energy efficiency interventions as well as making use of metering technology in order to measure the consumption and potential savings realised as part of the interventions put in place.

TABLE 12. KEY PERFORMANCE DATA FOR WCG BUILDINGS (ENERGY AND WATER CONSUMPTION)

	WCG OFFICE CONSUMPTION	CORPORATE OFFICE BENCHMARK AVERAGE
Energy consumed per FTE 2015 (kWh/m ²)	178.1	273.7
Water consumed per FTE 2015 (m ³)	20.26	27.81

The potential to enhance the environmental performance of WCGs property portfolio relies on more accurate data and performance reporting.

At 178 kWh per m², energy consumption across WCG offices is lower than the corporate office occupier average consumption of around 273 kWh per m². Through consolidating space and better use of offices WCG can improve both cost and space efficiency and reduce the environmental impacts of its property.

BOX 7 WCG: DEPARTMENT OF HEALTH CASE STUDY

Regular monitoring and reporting of utilities consumption data across the Western Cape hospitals has created valuable and effective data resources to drive future efficiency improvements in the Province's hospitals and clinics. The initiatives and project was set up by Western Cape Government: Health to understand and monitor the efficiency of utilities consumption for 52 hospital sites with a total area of 1.3 million m². The project has already secured savings and improvements at several sites.

Energy and water consumption represent two very significant resource requirements of the hospital estate and initiatives to understand and reduce wastage can have significant economic and environmental impacts. Around R225 million was spent on utilities across the hospital estate during 2013/14. The monitoring system implemented by WCG: Health recorded data from utilities accounts on a database to equip engineers with insights into performance to prompt further analytical studies. The data resource has facilitated like for like comparison across the estate with internal benchmarking enabling WCG: Health to determine benchmarks and targets for electricity and water consumption. The latter have been included in the WCG: Health Annual Performance Plan where performance is now monitored by the Departmental Monitoring and Evaluation Committee.

The information gathered confirms and pinpoints increases in usage, quickly identifies where wastage is evident and has helped to quantify the impact on consumption of "green" building design in the health sector. At a provincial level the data has highlighted that regional hospitals consume around 5% more energy per m³ than district hospitals but provide just 15% more hospital space per bed.

By using this data and tracking performance, WCG: Health aims to achieve savings in the short term of

Continued on page 47 >

< Continued from page 47

R7 million per annum. However, the potential for further savings through behavioural change and viable engineering interventions is estimated to be in the order of R30 million per annum.

The initiative clearly demonstrates the value which access to accurate and timely performance has delivered. The information enabled pro-active management of utilities across the hospitals delivering savings, efficiency improvements, and improved healthcare facilities.

MUNICIPAL ENERGY EFFICIENCY

Municipalities also play a key role in implementing energy efficiency through optimising their own operations and encouraging their consumers to implement energy efficiency interventions. The Department of Energy's (DoE) Energy Efficiency Demand Side Management (EEDSM) fund (through the Division of Revenue Act (DORA)) allows municipalities to access funds to retrofit building lighting, street lights and traffic lights. In 2014/15, six Western Cape municipalities accessed EEDSM funding.

TABLE 13. ENERGY EFFICIENCY AND DEMAND SIDE MANAGEMENT GRANT FOR WESTERN CAPE MUNICIPALITIES IN 2014/15

MUNICIPALITY	ALLOCATION
City of Cape Town	R 10 000 000
Swartland	R 10 000 000
Kannaland	R 4 000 000
Hessequa	R 4 000 000
Mossel Bay	R 4 000 000
Beaufort West	R 4 000 000

PRIVATE SECTOR ENERGY EFFICIENCY

It has been proven that energy efficiency saves industrial and commercial firms money, increases the reliability of operations, improves security of supply and offers attractive financial and economic returns, while promoting job creation and reducing CO₂ emissions. It also has a positive effect on productivity and competitiveness.

The Private Sector Energy Efficiency Programme (PSEE) run by the National Business Initiative (NBI) has assisted around 4 500 businesses nationally (approximately 250 in the Western Cape) in reducing their energy costs through targeted training workshops, toll-free support and web-based tools. The workshops provided small businesses with an opportunity to make the connection between how behaviour impacts the energy efficient and associated costs of the businesses. The results include the identification of opportunities for no-cost or low-cost measures that could typically lead to a 20% saving in energy costs. The main project objective is to support the improvement of energy efficiency across various sizes of business in the industrial and commercial sectors in South Africa, through the provision of a variety of services to identify and implement energy saving measures. This programme came to an end in November 2015.

BOX 8 INDUSTRIAL ENERGY EFFICIENCY PROJECT

The Industrial Energy Efficiency (IEE) Project was introduced in 2010 to contribute to the sustainable transformation of energy use practise in South African industry and enhance national energy security. The project is implemented by the National Cleaner Production Centre (NCPC-SA), in partnership with the United Nations Industrial Development Organisation (UNIDO).

Between 2010 and 2015, the IEE Project assisted large and medium industrial companies in saving 1.8 billion kWh (1 800 GWh) of energy, which equates to the energy required to electrify 250 000 middle-income homes. This translates to a realised financial saving of R 1.5 billion by the companies and a reduction in CO_{2e} emissions of 1.7 million tonnes nationally.

In the Western Cape, savings achieved by 12 companies amount to 902 million kWh (902 GWh) in energy; R 958 million in energy costs; and 0.8 million tonnes of carbon emission mitigation, almost half of the savings reported nationally. Potential savings of 71 million kWh in energy, R 62 million and CO_{2e} reduction of 68,000 tonnes have been identified in 95 SMEs in the Western Cape that were assessed between 2011 and 2014.

The IEE project takes a holistic approach, integrating the promotion and adoption of energy management systems (EnMS) and energy systems optimisation (ESO) with the building of expertise and capacity available to industry, both internally to the plants and in consultancy. Company participation options range from energy assessments for small and medium-sized enterprises to becoming demonstration plants where measurable and verifiable impacts of recommended energy system optimisation interventions may be showcased.

The NCPC-SA and UNIDO will embark on the second phase of the IEE Project (2016 – 2019) with national targets of 3.4 billion kWh in Energy Savings realised and 3 million tonnes of CO_{2e} reduced. The new phase is aimed at:

- Mainstreaming the proven approach of Energy Systems Optimisation (ESO) assessments and Energy Management Systems Implementation (EnMS) facilitation;
- Supporting data rich decision support to policy formulation through energy efficiency policy and regulations;
- Aiding the mobilization of investment through implementation facilitation offering project management and measurement support and project funding advisory services; and
- Broadening the training offerings including the development of Chiller, Refrigeration, HVAC and Process Heating Systems optimisation and two SAQA approved National Energy Efficiency qualifications.

In addition, the new phase intends to overcome funding barriers identified during the first phase through initiating workshops with financial institutions on streamlining the funding of energy efficiency projects to drive accelerated energy efficiency savings in South African Industry.

SOLAR WATER HEATERS

The large scale rollout of solar water heaters is a key intervention to support energy efficiency and address energy poverty. The rollout of SWHs to date has been much smaller than planned due to technical and regulatory issues. DoE has not updated their national target of 1 million SWHs by 2014/15 and the National Development Plan posts a national target of 4 million SWHs by 2030.

The subsidy for Low Pressure SWHs was cancelled at the beginning of 2013 in favour of a contracting or least cost tender approach. To date, this tender has been advertised on a number of occasions but still has not been implemented.

By the end of the 2nd quarter of 2013, a total of 52 013 high pressure SWH units had been installed on the Eskom SWH Programme as shown in Figure 8. Over time, this would represent approximately 90% of all installations of high pressure (HP) domestic SWH in South Africa during the peak of the Eskom rebate programme. The Western Cape had 14 889 (29%) applications submitted during the rebate period.

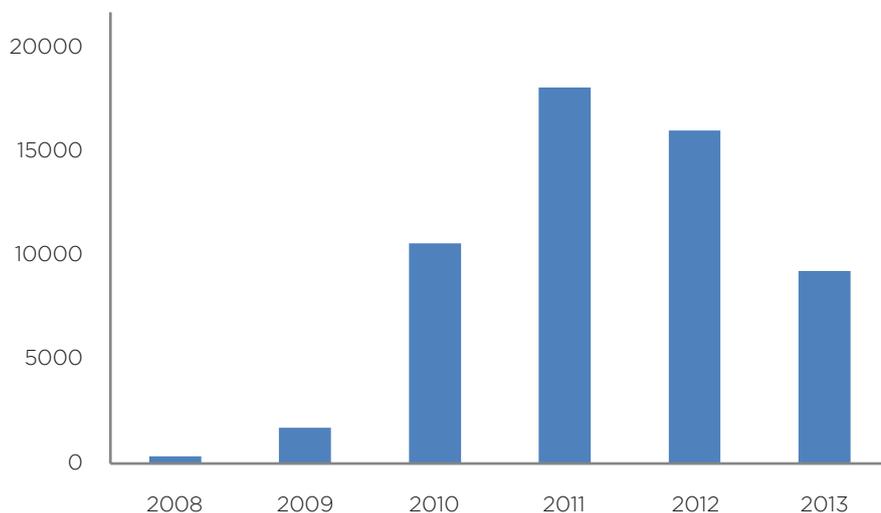


FIGURE 8. Total SWH Installations per year on Eskom rebate

The City of Cape Town successfully launched its solar water heating programme towards the end of 2013. The programme targets the installation of approximately 150 000 SWH. The City has identified the key barrier to uptake of HP SWH as lack of financing and lack of credibility amongst the installers. SANS 10 400 XA, which is focussed on energy use in buildings is applied to the National Building Regulations. This standard requires that a minimum of 50% of water heating in new buildings comes from efficient sources, with solar water heater or heat pumps. This is being managed by the municipal building control process. The requirements for low cost housing are discussed in the Human Settlements Section.

RENEWABLE ENERGY

Renewable energy (RE) is gaining more momentum with advancements and adoption of RE technologies such as solar photovoltaics, wind energy, biogas and other biofuels, hydroelectricity, landfill gas, geothermal energy and concentrated solar power, amongst others. International commitments, government policy support, sustainability concerns, procurement programmes, declining technology costs and increasing conventional electricity prices are key drivers of this shift, especially in the South African context.

The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) is one of the primary pathways to entry into the RE market for utility-scale power generation. Since its establishment in 2011, the REIPPPP has sanctioned over 5 000 MW in four bidding rounds. Presently, 77 projects covering solar photovoltaics (PV), onshore wind, biomass, small hydro, concentrated solar power (CSP) and landfill gas technologies were in various stages of development. Thirty-two projects

and uptake of small scale embedded generation (SSEG) in Western Cape Municipalities. In order to create a safe and conducive environment for the growth of the SSEG market, the Western Cape Government has been working closely with GreenCape to develop and promote the necessary guidelines, by-laws and tariffs. Of the 25 local and metropolitan municipalities in the Western Cape, ranging from the smallest (Laingsburg) to the largest metro (the City of Cape Town) the following has developed over the past year in terms of allowing SSEG, SSEG feed-in, the existence of approved SSEG tariffs and SSEG rules, regulations and policies.

With the support and guidance of GreenCape (Table 14):

- 15 municipalities allow SSEG to be installed within the municipal boundaries⁵⁷;
- 10 municipalities allow SSEG to feed into the local municipal grid;
- 4 municipalities have SSEG tariffs approved by National Energy Regulator of South Africa (NERSA); and
- 4 municipalities have SSEG rules & regulations in place.

TABLE 14. THE NUMBER OF WESTERN CAPE MUNICIPALITIES WITH SSEG REGULATIONS AND TARIFFS.

	ALLOW SSEG NUMBER OF MUNICIPALITIES	ALLOW SSEG TO FEED INTO THE GRID	SSEG TARIFFS IN PLACE	SSEG RULES & REGULATIONS IN PLACE
Yes	15	10	4 (3 experimental)	4
No	3	4	7	4
Unknown	2	5	6	6
No rules	5	4	0	0
In progress**	0	2	8	11

** the 'In Progress' municipalities are getting direct support from GreenCape to have the process completed by August 2016

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

- Facilitating the implementation of the mitigation measures highlighted in the Western Cape Climate Change Mitigation Scenarios for the energy sector report across the sectors.
- Energy consumption is characterised by diversity. There are some highly energy efficient office buildings within the estate but investigation into the performance of the least efficient will undoubtedly uncover significant scope for improvement.
- Inadequate access to data translates into poor transparency and as a hurdle to identifying issues and successfully managing local improvements to consumption. The reliability and access to energy and water consumption data is variable.
- Systems need to be set up to accurately calculate the savings realised through private sector energy efficiency and renewable energy interventions.

⁵⁷Five of these fifteen do not allow the installations to feed electricity back onto the grid.



WASTE MINIMISATION AND MANAGEMENT

The current priorities for addressing waste minimisation and management in the Western Cape include:

1. Development of waste characterisation profiles for municipalities in the Western Cape;
2. Promotion of the waste economy and identification of opportunities to reduce waste going to landfill; and
3. Development of waste-to-energy generation opportunities for both municipal and private (industrial and commercial) waste systems.

TABLE 15. WASTE INDICATORS FOR THE WCCRS

HIGH LEVEL CATEGORY	INDICATOR	DATA
GHG emissions	GHG emissions associated with the waste sector	2 348 249 tCO _{2e} (2009)
Municipal Waste Generation	Municipal solid waste generated annually	3 807 765 tonnes (2012)
Waste diverted from landfill	% waste diverted from landfill annually	9% (2012)

The National Greenhouse Gas (GHG) Inventory⁵⁸ (2000-2010) attributes 5% of national GHG emissions to the waste sector⁵⁹. As such part of the 2009 Western Cape Energy Consumption & CO₂ emissions report, an estimate of the waste-related emission was undertaken. The estimated waste-related emissions for the Western Cape was 2 348 249 tCO_{2e}, based on the waste generation figure as well as the composition of the waste in 2009.

Although a complete GHG Inventory will include emissions associated with energy, waste, industrial process and product use and agriculture, forestry and other land use (AFOLU), the Western Cape Energy Consumption of & CO₂ emissions report completed in 2012 only gives an indication of the energy and waste emissions.

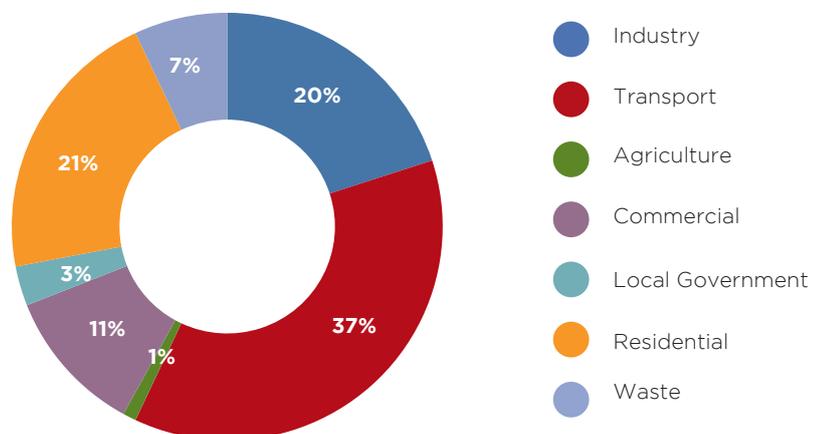


FIGURE 10. Waste and energy related CO_{2e} emissions by sector for the Western Cape (%)

⁵⁸The National GHG Inventory emissions proportions are: Energy (85%), Waste (5%), Industrial Processes and Product Use (5%) and AFOLU (5%) - making up 95% of total GHG emissions for the country.

⁵⁹International studies have, however, shown that this figure could be as high as 10% in some countries.

Solid waste is responsible for 7% of the province's GHG emissions, when only considering energy and waste sector emissions as shown in Figure 10.

In 2010, the WCG: Environmental Affairs and Development Planning completed an Integrated Waste Management Plan, which was developed to facilitate the implementation of the National Environmental Management: Waste Act (Act 59 of 2008). The latter would improve waste management in the Western Cape by:

- Promoting sustainable waste management – this includes waste avoidance, cleaner production, waste minimisation, resource-use efficiency, resource recovery and recycling;
- Diverting waste from landfill sites;
- Minimising adverse environmental and social impacts of waste management, particularly for the vulnerable; and
- Providing guidance and support for both municipalities and industries on developing Integrated Waste Management Plans, based on a standard which promotes Integrated Waste Management.

The Integrated Waste Management Plan (2012) is based on a waste hierarchy (Figure 11), which sets out the relative value and priority of different methods of waste management with waste avoidance and minimisation as the first option that needs to be applied by all sectors of society.

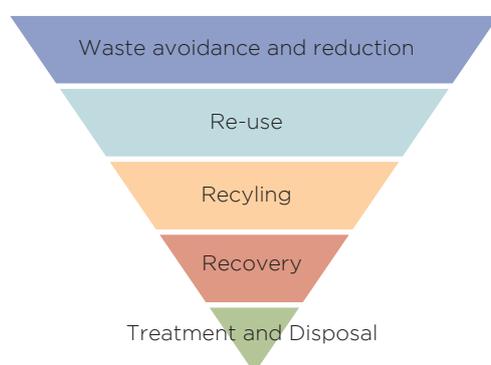


FIGURE 11. The Waste Management Hierarchy

All activities that reduce the amount of waste going to landfill will play a role in reducing the GHG emissions associated with the waste sector. A number of municipalities in the Western Cape have embarked on waste minimisation initiatives over the past few years with the aim of decreasing the amount of solid waste which is landfilled. This has resulted in 9% of waste being diverted from landfills in the Western Cape⁶⁰.

While waste has traditionally been viewed as a by-product to be disposed of, this opinion has radically transformed over recent years. “Waste” can play a role as a valuable resource to further economic growth in manufacturing of second generation products, materials recovery and recycling industry, generation of energy, up-cycling and art, amongst others whilst contributing to achieving our aim of decreasing emissions. This shift in the management approach to waste provides positive relief to the pressure placed on our finite resources, e.g. less virgin materials

⁶⁰Green Economy Report 2015.

used in manufacturing. It further results in less waste needing to be landfilled, and further reductions can be realised if the waste is used as a source of energy generation (as a final consideration before disposal to landfill)⁶¹.

The environmental thresholds for waste-to-energy projects triggering environmental authorisations are small and are requiring multiple environmental authorisations. There are a number of waste-to-energy facilities that have been licensed in the Western Cape. Twelve facilities, which include anaerobic digesters, biogas, biomass fuel combustion and pyrolysis, have been licensed. A number of these facilities are in the agricultural sector.

BOX 9 METHANE AS A GHG CONTRIBUTOR

Waste disposal facilities are one of the largest anthropogenic sources of methane (CH₄). Landfill methane is produced when organic materials are decomposed by bacteria under anaerobic conditions. Methane production varies greatly at each facility depending on site-specific characteristics such as waste quantities, composition, moisture content, landfill design, operating practices and climate. Unless captured first by a gas recovery system, methane generated by the disposal facility is emitted when it migrates through landfill cover. During this process, the soil oxidizes approximately 10% of the methane generated and the remaining 90% is emitted. Methane is a powerful GHG with approximately 72 times as much global warming potential than CO₂ over a 20 year period.

A waste stream analysis was undertaken for the purpose of compiling the Western Cape Integrated Waste Management plan. The characterisation/ composition of waste is not only a key requirement for successful waste planning, but for understanding the GHG potential from this sector. The characteristics of the different districts are shown in Figure 12.

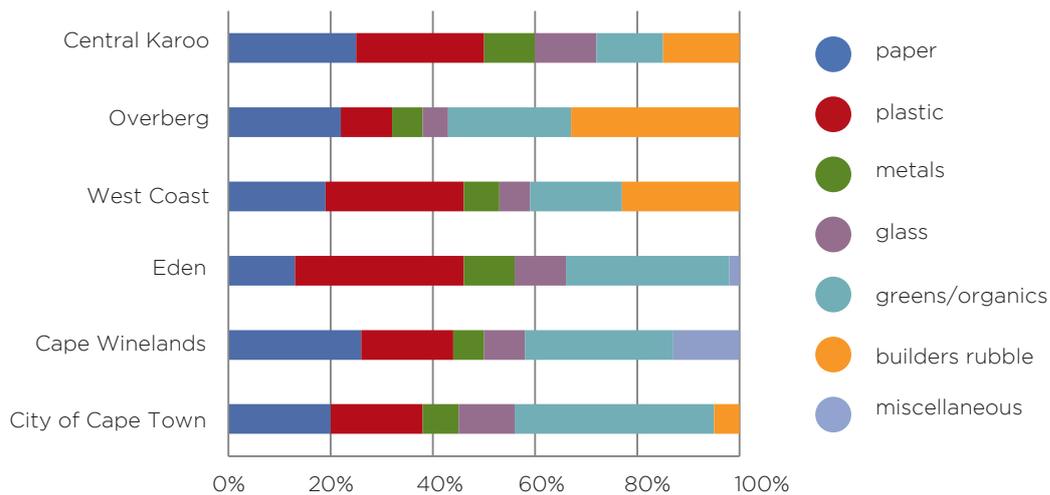


FIGURE 12. Waste stream analysis for the Western Cape (2010)

⁶¹ The recovery and use of methane from waste disposal facilities can significantly reduce the release of GHGs. Landfill methane can be collected or extracted from mature landfills by developing gas recovery systems on it can then be used for nearby industrial purposes, or enriched and sold to gas suppliers. Using climate friendly municipal solid waste solutions can therefore yield energy, economic, environmental and public health benefits.

TABLE 16. ESTIMATED WASTE GENERATION IN WESTERN CAPE DISTRICT MUNICIPALITIES (2010)

METRO AND DISTRICT	ESTIMATED MASS (T)	ESTIMATED PERCENTAGE OF WC WASTE
CCT	2 670 836	70
West Coast	190 004	5
Cape Winelands	453 505	12
Overberg	151 618	4
Eden	302 745	8
Central Karoo	38 066	1
Total	3 807 765	100

BOX 10 THE WESTERN CAPE INDUSTRIAL SYMBIOSIS PROGRAMME (WISP)

The Western Cape Industrial Symbiosis Programme (WISP) is a free facilitation service that connects companies so that they can identify and realise the business opportunities enabled by using unused or residual resources (materials, energy, water, assets, logistics and expertise). WISP uses various tools to engage with companies including Business Opportunity workshops, individual company meetings and site visits, as well as awareness raising at industry events. These methods allow WISP to build a network of companies and identify underutilised resources which could lead to business opportunities for member companies. A very important role of the WIPS team is managing the progression of the synergies identified, including building and maintaining relationships, developing business cases for member companies, assisting companies with other requirements for the implementation of synergies, the creation of completed synergy case studies for member companies and reporting on the effectiveness of the programme.

TABLE 17: AGGREGATED LIST OF VERIFIED OUTCOMES OF WISP⁶²

KEY PERFORMANCE INDICATORS	YEAR 1 (2013/14)	YEAR 2 (2014/15)	YEAR 3 (2015/16)	CUMULATIVE TO DATE (2013 - 2016)	ESTIMATED FIVE YEAR IMPACT ⁶³
Waste diversion (Tonnes)	59	339	1 357	1 752	8 455
Additional revenue (R million)	2.90	1.28	1.47	5.11	7.40
Cost savings (R million)	2.70	2.30	3.14	7.04	14.4
Private investment	100 000	-	-	100 000	
Fossil GHG savings (Tonnes (CO _{2e}) ⁶⁴)	1 100	1 500	2 800	4 900	22 100
Jobs Created	11 temporary 4 permanent	0 temporary 6 permanent 2 indirect 1 induced	3 temporary 2 permanent 3 indirect 3 induced	14 temporary 12 permanent 5 indirect 5 induced	14 temporary 12 permanent 5 indirect 5 induced

⁶² Table 17 is a list of verified outcomes for the entire WISP programmes since inception ending 31 March 2016. Taken from the WISP annual report March 2016

⁶³ Assuming no more synergies completed by WISP. Benefits achieved by those continuous synergies that achieve benefits year-on-year

⁶⁴ Carbon savings measured as fossil greenhouse gas (GHG) savings in carbon dioxide equivalents (CO_{2e})

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

- There is a strong move towards considering waste as part of the circular economy, where resources and materials can be re-used and recycled, returned back to the economy and used again to create a closed-loop production system. To realise the potential of these so-called secondary raw materials, we have to remove the existing barriers to the trade, improve the waste management practices and guarantee high quality standards.
- The need to improve waste monitoring data. In many cases the waste generation figure is based on estimation. Systems are being put in place to have regular data collection exercises in order to feed into the process.
- There is a need to understand the role the solid waste plays in the GHG emission profiles for the Western Cape. Although this is a small proportion in comparison to the energy sector, there are a number of opportunities for this sector and every contribution that is made can add to the emissions reductions.

SUSTAINABLE TRANSPORT



The current priorities for addressing sustainable transport in the Western Cape, include:

- Promotion of public and non-motorised transport, including the development of appropriate infrastructure;
- Investigation of opportunities for alternative transport fuels, including biofuels;
- Awareness raising and behaviour change programmes and transport models; and
- Government vehicle fleet efficiency programmes.

HIGH LEVEL INDICATORS	INDICATOR	DATA
GHG emissions	GHG emissions associated with the transport sector	146 296 370 GJ (2012/13) ⁶⁵
Public Transport	% of commuters who use public transport as main model of transport	43% (2013) ⁶⁶
Non-motorised transport	% of commuters who use non-motorised transport (NMT) as main model of transport	19% (2013) ⁶⁷
Integrated Public Transport Network	No of municipalities with Integrated public Transport Networks	2 (Cape Town and George)

GHG EMISSIONS ASSOCIATED WITH THE TRANSPORT SECTOR

Transportation is a key sector in the Western Cape economy, however it is extremely inefficient from a cost, energy, emissions and lifestyle perspective. The harmful effect that transport has on the environment as well as its socio-economic inadequacies, are of great concern, yet herein lies a great opportunity as the sector has huge potential for reducing GHG emissions, given that it is responsible for 53% of the energy consumption in the Western Cape. Requirements for diminished GHG emissions and improved air quality, coupled with potential limitation on the supply of fuel, are the drivers promoting an energy-efficient public transport systems.

⁶⁵Energy Consumption and CO₂ emissions database for the Western Cape for 2012/13 (WCG: EADP, 2015).

⁶⁶Update of the Western Cape 2016/17 – 2020/21 Provincial Land Transport Framework (WCG: TPW, 2016).

⁶⁷Update of the Western Cape 2016/17 – 2020/21 Provincial Land Transport Framework (WCG: TPW, 2016).

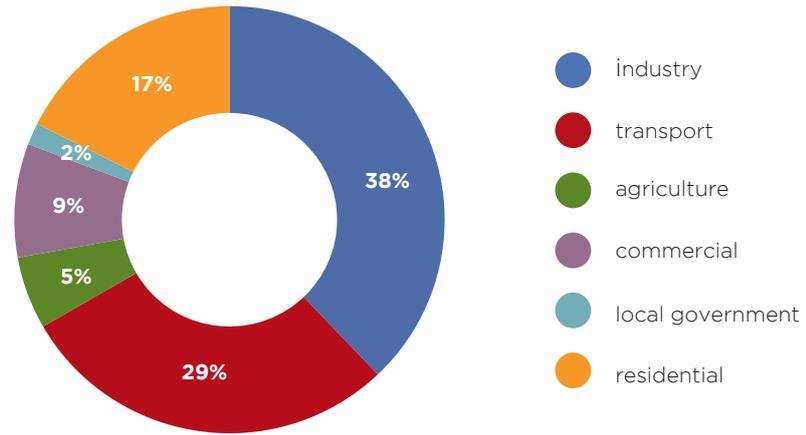


FIGURE 13: Emissions by Sector for the Western Cape (CO_{2e}: 2013/13)

The transport sector is responsible for 29% of Western Cape GHG emissions. National roads traversing a district have a profound effect on energy consumption in the area, as can be seen for Central Karoo district in Table 17, where 84% of energy consumed in the district is by the Transport Sector. This is as a result of the intensive use of the N1 and N12 national roads that run through this district. The land transport sector is also responsible for more than 50% of energy consumption in the Overberg and Eden districts. A national road runs through these districts, which increases liquid fuel use that is outside the management control of local municipalities.

TABLE 18: ENERGY CONSUMPTION AND EMISSIONS PER DISTRICT FOR THE TRANSPORT SECTOR

	CITY OF CAPE TOWN	CAPE WINELANDS	OVERBERG	EDEN	CENTRAL KAROO	WEST COAST
Transport sector carbon emissions as % of district total	36%	17%	17%	28%	58%	13%
Transport sector energy consumed as % of district total	67%	40%	44%	57%	84%	16%

Figure 14 shows the proportional consumption of energy by the transport sector across the City of Cape Town and the districts in the Western Cape and highlights the City of Cape Town as the largest consumer of energy in the transport sector. 75% of energy consumed by the transport sector takes place in the City of Cape Town. This is strongly linked to the majority of Western Cape’s population residing and working in the City of Cape Town as well as the economic contribution of the region.

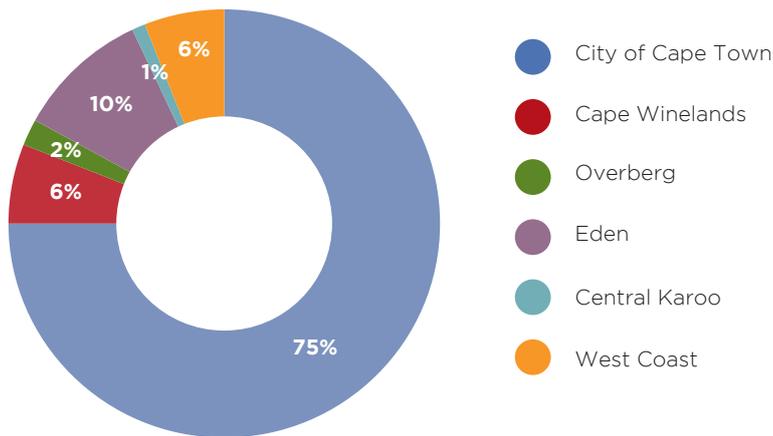


FIGURE 14: Percentage of provincial land transport energy used per district

The Western Cape Climate Change Mitigation Scenarios for the Energy Sector report looks at the mitigation measures for freight and passenger transport.

The freight transport measures consist of three broad types of measures:

- Modal shift from road to rail freight. This entails a shift from petroleum fuelled road transport, to more electricity-intensive rail freight. The potential of this measure depends greatly on the changing emissions factor for the national electricity supply;
- A road-based engine efficiency measure consisting of a freight vehicle mix in 2040 of 80% more efficient diesel engines, 10% natural gas powered vehicles and 10% diesel hybrid electric vehicles; and
- A rail-based engine efficiency measure whereby the freight engines will become 15% more efficient than they are now by 2040.

The primary mitigation measures assessed in the passenger transport sector include:

- Change of engine type from conventional internal combustion engine (ICE) to a suite of more energy efficiency vehicle types. The engine types considered include more efficient ICE, hybrid electric, plug-in electric hybrid, electric, fuel cell and compressed natural gas (CNG) powered vehicles. Change in all day modal split from the current split to a much more aggressive shift from private to public transport modes;
- Use of most efficient Electric Multiple Unit (EMU) rail stock (50% more efficient than current old stock), rather than replacement with the current new EMU (which are 20% more efficient than current stock); and
- Upgrading the voltage of metrorail lines by 2030, which is expected to result in a 10% reduction in electricity usage.

PROMOTION OF PUBLIC AND NON-MOTORISED TRANSPORT

A strategic goal of the Province is to enhance mobility and access in municipalities through the development, implementation and management of incremental public and non-motorised transport networks – Integrated Public Transport Networks (IPTN) – especially in priority non-Metro areas of the Western Cape, incorporating both the principles of the Provincial Public Transport Institutional Framework (PPTIF) and the lessons learnt through the George IPTN process.

Support for non-motorised transport (NMT) is a key strategy for the Province. It is the role of local and district municipalities to identify projects for consideration in planning and funding processes. Non-motorised transport route facilities have been constructed in a number of urban and rural locations in the Province, some serving specific users (such as scholars) or purposes (such as access to public transport) and others providing for general mobility in urban and rural areas.

As is the case nationally, the largest modal shift in Western Cape’s passenger transport during the last decade has been the decline in the share of NMT from 42% in 2003 to 19% in 2013 and the increase in the share of minibus taxis (10% - 26%) and private cars (from 32% - 37%) between 2003 and 2013.

TABLE 19: MODAL SPLIT BY TRANSPORT MODE IN DISTRICTS

	CITY OF CAPE TOWN	CAPE WINELANDS	OVERBERG	WEST COAST	EDEN	CENTRAL KAROO	TOTAL
Train	14%	5%	1%	2%	1%	2%	11%
Bus	18%	2%	4%	4%	5%	5%	7%
BRT	1%	0%	0%	0%	0%	0%	0%
Minibus Taxi	26%	21%	14%	24%	35%	35%	26%
Car	37%	45%	47%	43%	26%	26%	37%
NMT	14%	27%	34%	27%	33%	33%	19%
Passenger Modal Split (not incl NMT) [Priv:Pub 2003]	54:46	58:42	59:41	58:42	67:33	68:32	55:45
Passenger Modal Split (not incl NMT) [Priv:Pub 2013]	43:57	63:28	71:29	59:41	39:61	49:51	46:54

From Table 18 it is evident that private cars become the dominant mode in most districts in 2013 apart from in the Central Karoo and Eden where NMT still plays a dominant role. Minibus taxis play the dominant role in passenger transport in Eden district and increased its share substantially in all districts as well as the CCT. Motorised passenger transport in the Western Cape has shifted from private to public transport since 2003. According to the National Household Travel Survey (2013), 54% of the daily motorised transport trips across the Western Cape were via public transport mode (mainly minibus taxi) in 2013 as opposed to 45% in 2003. In the Cape Winelands and Overberg districts, private cars dominate as main mode of motorised transport.

Currently 2 municipalities have implemented Integrated Public Transport Networks in the form of MyCiTi in the City of Cape Town and GoGeorge in George (see Box 10). MyCiTi is a bus rapid transit service with feeders

which forms part of a greater Integrated Public Transport driven economic development strategy of the City of Cape Town that started in 2010. From Atlantis in the north to Hout Bay in the south, and from Mitchells Plain and Khayalitsha in the east to Sea Point in the west, there are currently 37 MyCiTi interconnected routes, serving 42 stations and 366 stops.

BOX 11 THE GEORGE INTEGRATED PUBLIC TRANSPORT NETWORK (GIPTN)

The George Integrated Public Transport Network (GIPTN) provides a new and improved public transport system for George and surrounding areas. The first trial phase launched on 8 December 2014, with routes rolling out in phases over the following months.

The aim is to provide a quality public transport service that is reliable, affordable, safe, convenient and accessible that contributes to an improved quality of life. At the heart of the project is an empowerment model that sees current public transport operators who were operating minibus taxi or bus services in George forming a company to deliver the new scheduled bus service in terms of a contract. The George Municipality, with the support of the WCG, has negotiated a 12-year contract with this new company, in line with national government policy. Part of the agreement is that other public transport services cease to operate on the GoGeorge routes.

A primary objective of the province is to increase the role of NMT as a key transport mode, and together with the integration between NMT and public transport is seen as vitally important. NMT should act as the feeder system to public transport, and the ease and convenience with which NMT users can access the public transport system will promote and enhance the utilisation of both modes at the same time. With high traffic congestion levels in the main cities and towns, effective and efficient public transport systems are being implemented in a structured way.

In order to improve the sustainability of the province's transport system the province needs to facilitate a progressive model shift from road to rail and from private to public transport, in order to achieve sustainable mobility.

INVESTIGATION OF OPPORTUNITIES FOR ALTERNATIVE TRANSPORT FUELS, INCLUDING BIOFUELS

There are a number of initiatives underway to investigate the effectiveness of alternative transport fuels for both the passenger and freight transport systems. At the time of drafting the Western Cape Climate Change Response Strategy there was a strong national and provincial focus on biofuels as an alternative fuel. This included the development of a National Biofuels Industrial Strategy, but the impact of the international oil price has led to less emphasis on this sector, although there is still work taking place.

There are a number of pilot projects underway where electric cars and hybrid vehicles are being used by businesses and government departments, including DEA, which has a small fleet of electric vehicles available for use by their staff. Discussions are taking place around

the infrastructure required in order to see a larger uptake of these technologies. Alternative and more efficient vehicles are highlighted as a key mitigation measure for the transport sector in the Western Cape Climate Change Mitigation Scenarios for the Energy sector.

Studies have also been undertaken on the feasibility of biofuels for fleet services, including a pre-feasibility study undertaken by GreenCape in partnership with Scania, WCG and CCT; where an investigation into the potential for the use of sustainable biofuels in South Africa, with a focus on waste-based bioethanol for fleet transport in the Western Cape was conducted. This project was funded by the Swedish International Development Agency.

DEA undertook a study (*Facilitation of large-scale uptake of alternative transport fuels in South Africa – a case for biogas*) to establish an understanding of the economic and practical potential of compressed biogas (CBG) as an alternative transport fuel. The project included the following objectives:

- The development of a national biogas inventory including (as far as accessible and available) an indication of the quantity, quality and availability of biogas as a potential transport fuel;
- An assessment of the financial viability of the main CBG production processes, as well as the macro-economic effect and the national greenhouse gas (GHG) mitigation impact; and
- The identification of opportunities for policy interventions by government in collaboration with business, with the aim of stimulating the application of CBG as an alternative transport fuel.

AWARENESS RAISING AND BEHAVIOUR CHANGE PROGRAMMES AND TRANSPORT MODELS

There are numerous ad hoc programmes underway to promote behaviour change around transport and to raise awareness about alternative transport modes, particularly to encourage commuters to shift to public transport.

One such programme that the Western Cape Government partnered the CCT was TravelSmart. It focussed on getting people to shift towards more sustainable transport options, reducing travel costs, improving health and lowering the impact on the environment. TravelSmart focussed specifically on reducing the number of single occupant vehicles travelling on the road. It provided information to users on more sustainable travel options such as forming or joining lift clubs, using public transport or switching to non-motorised transport options such as bicycling or walking. Messaging about these options and contact information on the TravelSmart programme was sent to employees of the Western Cape Government.

GOVERNMENT VEHICLE FLEET EFFICIENCY PROGRAMMES

The Transport Flagship Programme under the National Climate Change Response White Paper includes a Government Vehicle Efficiency Programme that will improve the efficiency of the government vehicle fleet by 2020. It encourages new efficient-vehicle technologies such as electric vehicles, by setting procurement objectives for acquiring such vehicles.

To date, the WCG vehicle fleet has not included new vehicle technologies, but discussions are taking place on how this can be implemented.

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

- There is a need for better understanding of the impact that climate change has on transport infrastructure. This includes damage caused by increased flooding as well as the influence of rising temperature on road surfaces. Integrating the potential impact of climate change on transport infrastructure should form an important component of disaster risk management plans of local municipalities as well as transport planning documents at all levels of government.
- A better understanding of the uptake of alternative fuels/new vehicle technologies is required in order to understand the mitigation potential for the transport sector. A lot of activities are taking place in the shift to more efficient public transport systems, but there are a number of opportunities for private vehicles and freight in taking this work forward.
- Energy futures modelling undertaken in the CCT energy futures modelling showed that the single biggest mitigation intervention for transport, particularly in the short term, would be increasing vehicle occupancy numbers as opposed to improved uptake of public transport and efficient vehicles. A better understanding of the interventions that will cause people to make this change is required in order to understand how to rollout a programme to encourage higher vehicle occupancies.
- A better understanding of the freight sector is required to fully understand its role in the transport sector and its potential for mitigation of GHGs.



HUMAN SETTLEMENTS

The current WCCCRS priority areas for addressing Human Settlements in a changing climate include:

1. Mainstreaming climate change into human settlement developments;
2. Implementation of energy efficiency interventions in low income houses and communities; and
3. Improving the resilience and adaptive capacity of informal settlements.

TABLE 20: HUMAN SETTLEMENTS INDICATORS FOR THE WCCCRS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Human Settlements	Number of state-subsidised houses built in province that makes use of climate-resilient technologies in the designs (2015/16) ⁶⁸	1750 (incomplete data) ⁶⁹
Human Settlements	Number of state-subsidised houses built in the Province that comply with the updated ⁷⁰ National Norms and Standards for the Construction of Stand Alone Residential Dwellings and Engineering Services (based on the requirements of SANS 10400 XA)	First measurements will be reported on in the 2015/16 WCG: Department of Human Settlements Annual Report

In South Africa generally and the Western Cape, in particular, the provision of low-income housing has driven the spatial expansion of towns and cities. The imperative of responding rapidly to housing needs has led the state and developers to search for low cost land, most of which is on the periphery of urban areas, for the development of subsidised housing projects. While these projects have substantially increased housing availability, there have been a number of negative aspects that have implications for climate change planning.

Firstly, the programme has been unable to keep pace with demand. According to the 2011 Census, 9% of households still reside in informal settlements, of which the vast majority are in urban areas. These settlements are vulnerable to floods and fires, exacerbated by their location in flood- or ponding-prone areas and on sand dunes, by inferior building materials and/or poorly designed infrastructure. Secondly, most housing projects that are constructed are far from services and amenities. Infrastructure and service delivery to these areas bears large costs for the state, the households, and the environment. These areas tend to be homogeneous (i.e. only low income housing), lacking diversity and resilience.

The impact which human settlement development has on the environment and resource use, coupled with the scale at which delivery is taking place, creates an opportunity and imperative to consider climate

⁶⁸In future iterations of this report this indicator will be shown as a percentage of all houses delivered; due to incomplete data this is not currently possible.

⁶⁹Department of Human Settlements Annual Performance Plan, 2015/16.

⁷⁰As of December 2013.

change. These considerations are relevant for all existing and planned low income and informal settlements and should aim to improve the resilience, adaptive capacity, and resource dependency of settlements and the urban areas.

MAINSTREAMING CLIMATE CHANGE INTO HUMAN SETTLEMENT DEVELOPMENTS

The Western Cape Government: Human Settlements (WCG:HS) is in the process of developing various policies aimed at making service delivery more sustainable in the long term, focussing not only on financial sustainability, but also on social as well as environmental sustainability. Although the focus often does not explicitly consider climate change, the current context prescribes it of any sustainable plan, as it speaks to all three facets of sustainability:

- Financial losses related to maintaining and servicing settlements under a changing climate and especially during climate related disaster events;
- the increased social sustainability that climate-proofed settlements offer residents; and
- the climate impacts of human settlement development and operations (e.g. the emissions from building and operating these settlements).

A variety of relevant policies and programmes have recently been developed, or are in development by the WCG which will assist in setting the platform for a transitioning human settlements sector. These are captured in Table 20.

TABLE 21: HUMAN SETTLEMENT POLICIES AND PROGRAMMES RELEVANT TO CLIMATE CHANGE RESPONSE.

POLICY, PLAN OR PROGRAMME	DESCRIPTION
Western Cape Land Use Planning Act 2014 (Act No. 3 of 2014).	Replaces the Land Use Planning Ordinance, and is aligned with National Government's SPLUMA Regulations. It introduces a new order for land use planning and attempts to ensure the effective integration of planning activities across the provincial and municipal governments. LUPA promotes the principles of densification and ensures that sustainability criteria are met.
Western Cape Informal Settlement Support Plan ⁷¹ (ISSP). [Draft]	Focuses on i) how the current informal settlement upgrades can be enhanced; ii) what needs to be done differently and iii) what resources and expertise are required to shift from historical outdated planning methodologies to innovative, alternative and sustainable interventions for informal settlements.
Green Procurement Policy Guidelines (for state-subsidised housing). [Draft]	Assists municipalities in i) following procurement processes for the development of housing that result in developments that emit reduced levels of carbon, ii) the development and housing designs that take a changing climate into account. This should result in developments that have a decreased climate risk.
Provincial Spatial Development Framework (PSDF) (2014).	The PSDF includes climate change as an issue to be addressed under the PSDF principle of <i>Sustainability and Resilience</i> , and also identifies it as one of the major future risk challenges the province will face. Various PSDF focus areas are linked to mitigation and adaptation.
Feasibility Study for Alternative and Sustainable Infrastructure and Services for Settlements (2015).	An investigation of the feasibility of alternative sustainable technologies currently on the market in settlement development. The outcomes indicated that in the long term it was financially more sustainable for municipalities to invest in more sustainable settlements using some of these alternative technologies instead of following a "business-as-usual" approach to settlement development.
PSDF specialist study on the municipal financial sustainability of current spatial growth patterns (2013).	The results from this study show that it is more financially sustainable for municipalities to pursue compact growth. A follow-up study was done using Mossel Bay Municipality as a case study (see below).
Mossel Bay Growth Options Study (2015) ⁷² .	This study included the non-financial impact of different growth footprints on biodiversity, ecosystem services, cultural landscape and agriculture, as well as social facilities and passenger transport; for all factors investigated the results indicate that compact growth is more sustainable than sprawling growth.
Western Cape Human Settlements Framework ⁷³ (WCHSF).	This is an overall guide to human settlement development in the Western Cape in the short, medium and long term (up to 2040), and will combat urban fragmentation and sprawl as well as promoting more integrated and sustainable settlement development.

In terms of incorporating alternative technologies into human settlement development, the WCG:HS is investigating and encouraging projects that will yield higher quality and more resource efficient settlements. The number of projects which include innovative technology initiatives (including technologies/techniques that increase climate resilience) will be measured as an annual performance indicator starting in 2015/16.

STATE-SUBSIDISED HOUSES THAT MAKES USE OF CLIMATE-RESILIENT TECHNOLOGIES IN THE DESIGNS

The number of state-subsidised houses built in province that makes use of climate-resilient technologies in the designs (refer to Table 19) is measured under the WCG:HS strategic departmental goal of promoting innovation and the better living concept. This will be achieved by increasing sustainable resource use through exploring innovative technologies in construction, energy, water and sanitation, and promoting the use of alternatives to achieve the most energy and cost effective development. As this is a new indicator the data will only become available once the WCG:HS 2015/16 Annual Report is published;

⁷¹ To be finalised March 2017.

⁷² DEA&DP. 2015. Mossel Bay Growth Options Study: A study on the municipal financial and non-financial impacts of sprawling vs. compact growth options. Final Report.

⁷³ To be finalised March 2018.

Table 21 gives the targets for this indicator for the next three financial years.

TABLE 22: HOUSING TARGETS SET BY THE WCG:HS FOR THE CONSTRUCTION OF HOUSES USING INNOVATIVE TECHNOLOGY INITIATIVES SUCH AS CONSTRUCTION, ENERGY, WATER, AND SANITATION

FINANCIAL YEAR	TARGET NUMBER OF HOUSES CONSTRUCTED
2015/16	3240
2016/17	4016
2017/18	3828

SANS 10400 XA FOR LOW-COST HOUSING

The national norms and standards for the construction of stand-alone residential dwellings and engineering services have been updated, based on SANS 10400 XA- Energy usage in buildings. As it was judged too expensive for government to implement these standards fully in low-income housing and still deliver housing at an acceptable rate, some concessions have been made, and the National Norms and Standards for the Construction of Stand Alone Residential Dwellings and Engineering Services have been adjusted to include some requirements from the SANS 10400 XA standard. For the standard 40m² house this includes an increased thermal performance over the previous standards (including ceilings, insulation, plastering, reduced window size, etc.), and is accompanied by increased housing subsidy quantum to cover the additional costs.

According to the new standards, all houses built from 2015/16 onwards should be compliant. These numbers are not available yet, as they will only be reported on in the 2015/16 WCG: HS Annual Report; targets set by the WCG: HS for the next five years are given in Table 22.

TABLE 23: HOUSING TARGETS SET BY THE WCG: HS FOR THE CONSTRUCTION OF HOUSES COMPLYING WITH THE UPDATED NATIONAL NORMS AND STANDARDS FOR THE CONSTRUCTION OF STAND ALONE RESIDENTIAL DWELLINGS AND ENGINEERING SERVICES⁷⁴

FINANCIAL YEAR	NUMBER OF HOUSES CONSTRUCTED
2015/16	10 240
2016/17	10 608
2017/18	10 072
2018/19	10 000
2019/2020	10 000

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

- One of the current gaps is that there is no dedicated human settlement legislation in the country; however this is in the process of being developed. This will include *inter alia* the improvement of planning, design and development of settlements, which will present an opportunity to include climate change resilience considerations during the development of the legislation.
- Clearer understanding of what resilience means for humans settlements.

⁷⁴Indicator in DoHS Strategic Plan: Total number of housing units delivered by 31 March 2020 (cumulative indicator).



BIODIVERSITY AND ECOSYSTEM GOODS AND SERVICES

The current WCCCRS priority areas for addressing biodiversity and ecosystem goods and services in the Western Cape in a changing climate include:

1. Prioritisation, valuation, mapping, protection, and restoration of ecological infrastructure;
2. Landscape initiatives / biodiversity corridors and identification of requirements for climate change adaptation corridors;
3. Biodiversity stewardship; and
4. Mainstreaming of conservation planning into decision making.

TABLE 24. BIODIVERSITY AND ECOSYSTEM GOODS AND SERVICES INDICATORS FOR THE WCCCRS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Biodiversity; Ecosystem Goods and Services	Percentage of the Climate Change Corridors (CCCs) that fall within conserved areas	2015: Currently less than 1% ⁷⁵
Ecosystem Goods and Services	Number of Ecosystem Goods and Services (EGS) mapped and utilised in planning tools	10 ⁷⁶
Biodiversity	Integration of biodiversity priorities in municipal Spatial Development Frameworks (SDFs)	Not adequately integrated: 34% Adequately integrated: 34% Excellently integrated: 31% ⁷⁷
Ecosystem Goods and Services	Number of wetlands rehabilitated per year	2013/14: 20 2014/15: 29 2015/16: 25 ⁷⁸

TABLE 25. ADDITIONAL HIGH LEVEL BIODIVERSITY AND EGS INDICATORS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Economic loss from ecosystem degradation	Estimated economic potential lost from ecosystem degradation per annum in the Western Cape	R4.5 billion ⁷⁹
Biodiversity	Percentage of the Western Cape's land that is under conservation management by CapeNature	6.81% (2014/15) ⁸⁰
Ecosystem Goods and Services	Percentage of wetland area in the Western Cape that falls within formally protected areas	8.8% (2015/16) ⁸¹

⁷⁵ CapeNature, 2015. CNC Reserves. Western Cape Nature Conservation Board; CapeNature 2015. Stewardship Sites - 2015 (Signed and Declared). Western Cape Nature Conservation Board]; SANBI 2010. *Formal Protected Areas*. SANParks.

⁷⁶ Genevieve Pierce, CapeNature, pers. Communication.

⁷⁷ Albert Ackhurst, Biodiversity Sub-Directorate, DEA&DP, March 2016, pers. Communication.

⁷⁸ Heidi Nieuwoudt, SANBI, pers. communication.

⁷⁹ WCG 2014. Western Cape Eco-Invest Project. Phase I: A Preliminary Assessment of Priorities and Opportunities for Mobilising Private Sector Investment in the Western Cape's Natural Capital.

⁸⁰ CapeNature Annual Report 2014/15.

⁸¹ CapeNature, 2015. CNC Reserves. Western Cape Nature Conservation Board; CapeNature 2015. Stewardship Sites - 2015 (Signed and Declared). Western Cape Nature Conservation Board]; SANBI, 2011. *NFEPA_Wetlands*. CSIR.

Climate change is one of the most important direct drivers of biodiversity loss and ecosystem service changes worldwide, and it may become the dominant direct driver of these changes by the end of the 21st century⁸². South Africa's biomes are expected to be impacted by climate change, as the current climates which influence conditions within the biomes are likely to shift⁸³.

For the Western Cape, in addition to habitat loss and direct impacts (such as increase in average temperature, increase in the frequency of extreme weather events, etc.), climate change is anticipated to further threaten the natural ecosystems of the province. Already, the economic losses resulting from general ecosystem degradation have been calculated to amount to R4.5 billion per annum⁸⁴, a figure that is likely to worsen given the future impacts from climate change. Within this century, the climate is likely to become warmer and drier, with less winter rainfall and more irregular and intense rainfall events⁸⁵. This will have various consequences for the province's economy, ecological integrity and livelihoods including:

- i) reduced water quantity and quality through negative impacts on rivers, wetlands and estuaries (see Water);
- ii) detrimental effects on biodiversity, including significant species losses in the Cape Floristic Region;
- iii) increased fire and flooding danger and frequency (see Climate Risk Management);
- iv) Increased danger to coastal towns due to sea level rise;
- v) threats to livelihoods, especially of the poor who are most vulnerable; and
- vi) impacts on economic sectors such as fishing, forestry, agriculture, insurance, banking, tourism, infrastructure and construction⁸⁶.

Given that intact biodiversity and functional ecosystem goods and services increase resilience to climate change, it is vitally important that our environment and biodiversity remain protected to decrease the impacts of climate change on human settlements, infrastructure and services, in the Western Cape. This would also prevent some of the climate change-associated costs that could otherwise lead to potentially crippling economic impacts in the province.

The 2013 State of Environment Outlook Report for the Western Cape (SOEOR) found that overall biodiversity and ecosystem health was declining, due to the continuing loss of biodiversity and general decline of the quality of our ecosystems (the biodiversity indicators tracked in the SOEOR can be viewed in Annex 3). Table 24 gives an overview of some high level biodiversity and ecosystem goods and services indicators relating to climate change, which are discussed further below.

⁸²Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC.

⁸³Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012. National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.

⁸⁴WCG 2014. Western Cape Eco-Invest Project. Phase I: A Preliminary Assessment of Priorities and Opportunities for Mobilising Private Sector Investment in the Western Cape's Natural Capital.

⁸⁵Midgley, G. F., Chapman, R. A., Hewitson, B., Johnston, P., de Wit, M., Ziervogel, G., Mukheibir, P., van Niekerk, L., Tadross, M., van Wilgen, B.W., Kgope, B., Morant, P. D., Theron, A., Scholes, R. J. and Forsyth, G. G. 2005. A Status Quo, Vulnerability and Adaptation Assessment of the Physical and Socio-economic Effects of Climate Change in the Western Cape. Report to the Western Cape Government, Cape Town, South Africa. CSIR Report No. ENV-S-C 2005-073, Stellenbosch.

⁸⁶Western Cape Protected Area Expansion Strategy: 2015 – 2020. 2015. Compiled by Maree, K.S., Pence, G.Q.K. and Purnell, K. 2015. Unpublished report. Produced by CapeNature. Cape Town, South Africa.

A number of programmes that address the identified threats to biodiversity and EGS from climate change are underway in the WCG. In 2009, twenty-eight Climate Change Corridors were identified in the Western Cape through an exercise undertaken with the support of the Table Mountain Fund (TMF⁸⁷). These corridors were taken into account when designing the Province's Protected Area Expansion Strategy⁸⁸. Expansion of the Protected Area Estate should therefore improve the protection of the climate change corridors and refugia. Landscape level initiatives are aiming to improve protection and land management in these corridors so that they maintain function. Relevant initiatives include:

1. Biosphere Reserves – represented by the Western Cape Biospheres Forum⁸⁹.
2. Landscape Initiatives coordinated or supported by CapeNature and represented at the CAPE Implementation Committee⁹⁰.

WESTERN CAPE LAND THAT IS UNDER CONSERVATION MANAGEMENT BY CAPENATURE

Whilst there is a declining state of biodiversity, much is being done to attempt to turn the tide on this. One of the ways this is being done is through increasing the conservation estate⁹¹, as well as restoring and rehabilitating key ecosystems [including wetlands (covered later in this section) and rivers (see focus area 5)]. In the last few years there has been an increase in the percentage of land in the Western Cape that is under conservation management (Figure 15) in line with targets set by CapeNature.

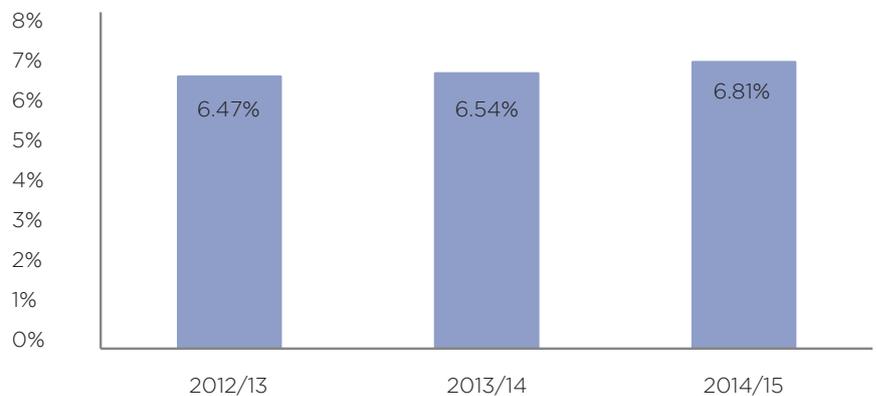


FIGURE 15. Percentage of land in the Western Cape that is under conservation management by CapeNature (CapeNature Annual Reports: 2012/13; 2013/14; 2014/15)

⁸⁷ Pence, G.Q.K. 2009. Climate Adaptation Scenarios for the Cape Floristic Region: Technical Report.

⁸⁸ Due to be finalised end March 2016.

⁸⁹ Which represents the four biosphere reserves: Gouritz Cluster, Cape Winelands, Kogelberg, and Cape West Coast.

⁹⁰ Includes the Agulhas Biodiversity Initiative (ABI), The Greater Cederberg Biodiversity Corridor (GCBC), Upper Breede Collaborative Extension Group (UB-CEG), Garden Route, and Addo-to-Eden Corridor.

⁹¹ The conservation estate referred to in CapeNature's strategic documents. This is defined as all sites declared by Government Gazette and/or formal agreement under NEM:PAA, (new state land and contract nature reserves, as well as contractual agreements, but not voluntary stewardship sites).

WETLAND AREA IN THE WESTERN CAPE THAT FALLS WITHIN FORMALLY PROTECTED AREAS

When comparing the formal conservation estate in the Western Cape (as defined by CapeNature) with a list of areas in the Western Cape classified as natural wetlands (obtained from Working for Wetlands), it can be seen that of the 208 149 ha of wetland area identified in the Western Cape, 18 366 ha (approximately 8.8%) falls within formally protected areas. Wetlands provide many important ecosystem goods and services such as water purification, flood attenuation, groundwater recharge and provision of habitats to key species.

CLIMATE CHANGE CORRIDORS THAT FALL WITHIN CONSERVED AREAS

The corridors were designed to target unprotected landscapes that still support intact connections between protected areas. To measure whether the conservation status of these targeted areas are increasing, the corridors were compared with the most up to date information on areas conserved by CapeNature and SANParks. Currently less than 1% of the corridor areas are formally protected⁹²; however additional portions that don't currently enjoy formal protection do fall within areas that are protected by virtue of their inaccessibility (e.g. mountainous areas) or conservation importance to other sectors (e.g. strategic water source areas). Despite this, it is vitally important to formalise the protection of these "informally" protected areas, as well as affording protection to the currently unprotected portions of those corridors.

A complimentary approach to the conservation strategies being followed by the WCG is to adopt spatial planning tools to take the importance of biodiversity and ecosystem goods and services into account during planning and development. Therefore, in addition to the Protected Area Expansion Strategy, the DEA&DP and CapeNature are also in the process of completing the Provincial Spatial Biodiversity and Ecological Infrastructure Plan⁹¹. This plan will prioritize areas for action and will include climate adaptation corridors and critical ecological infrastructure such as Strategic Water Source Areas and wetlands which increase climate change adaptive capacity and can act as a first proxy for an ecological infrastructure map.

ECOSYSTEM GOODS AND SERVICES (EGS) MAPPED AND UTILISED IN PLANNING TOOLS

As part of the abovementioned Spatial Biodiversity and Ecological Infrastructure Plan, CapeNature uses a set of biodiversity planning tools in terms of ecological infrastructure (through which EGS flows). Since EGS are rarely included directly in planning tools, these types of tools were used as a proxy indicator for planning tools that include EGS. These tools are:

1. Important water source areas [combination of Strategic Water Source Areas and High Yield Catchments, as per the National Freshwater Ecosystem Priority Areas (NFEPA)];
2. High groundwater recharge areas (NFEPA);
3. Climate change adaptation corridors;

⁹²Protected areas used in this analysis include areas that fall within CapeNature's conservation estate [CapeNature 2015. CNC Reserves. Western Cape Nature Conservation Board; CapeNature 2015. Stewardship Sites - 2015 (Signed and Declared). Western Cape Nature Conservation Board], as well as national nature reserves (SANBI 2010. Formal Protected Areas. SANParks).

4. Upland-lowland interfaces;
5. Estuarine functional areas;
6. Wetland clusters (NFEPA);
7. Ecosystem-based adaptation areas [as per the National Biodiversity Assessment (NBA 2011);
8. Riparian functional areas; and
9. Coastal corridors, which include: Fore dunes (specific value/service of providing physical buffering against sea storm surges).

These tools as well as the Provincial Biodiversity Strategy and Action Plan will be used by CapeNature when commenting on development applications or environmental impact assessments (EIAs), and will be incorporated in spatial development tools through the classification of specific areas of high ecological importance.

INTEGRATION OF BIODIVERSITY PRIORITIES IN MUNICIPAL SPATIAL DEVELOPMENT FRAMEWORKS (SDFS)

An additional planning tool is the integration of biodiversity and ecosystem priorities into municipal SDFs. SDFs are included in IDPs, and DEA&DP regularly assesses these documents to ensure that they include the necessary biodiversity planning and considerations. Figure 16 illustrates the DEA&DP assessment outcomes for the 29 Local Municipalities⁹³. The assessment on how well municipalities integrate biodiversity priorities in the SDF is done on approximately a five-year interval by the Biodiversity component of DEA&DP, which matches the SDF review cycle.

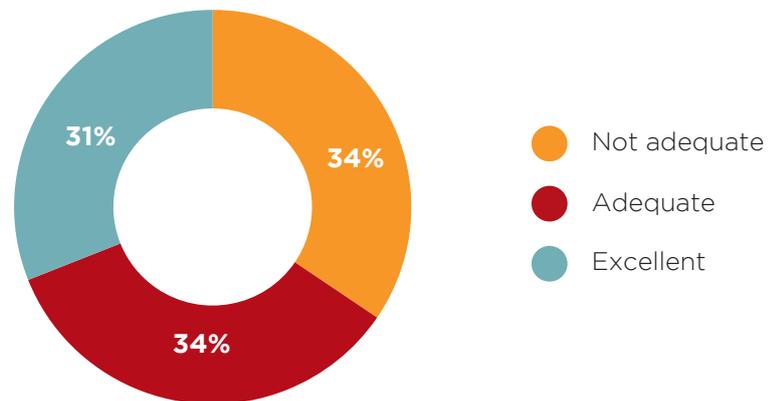


FIGURE 16. Degree to which biodiversity priorities were integrated into Western Cape municipal Spatial Development Frameworks^{94, 95}

⁹³The City of Cape Town was excluded from this analysis.

⁹⁴Municipal SDFs were assessed for a series of biodiversity-related considerations, for each of which a score was awarded. These scores were converted to an average overall score between 0 and 5, with 5 representing perfect inclusion of biodiversity-related considerations, and 0 representing no inclusion of biodiversity-related considerations. Municipalities who on average scored below 3 was deemed to be "not adequate", between 3 and 4 was deemed to be "adequate", and those that scored above 4 were deemed to be "excellent".

⁹⁵Albert Ackhurst, Biodiversity Sub-Directorate, DEA&DP, March 2016, pers. Communication.

Following on from the publication of the National Biodiversity Strategy and Action Plan (NBSAP) the WCG is also in the process of developing a Provincial Biodiversity Strategy and Action Plan⁹¹ (PBSAP) which is a high level long term plan that will govern biodiversity management in the Western Cape. The PBSAP core strategic objectives are:

1. Conserve and reduce threats and pressures on biodiversity;
2. Mainstream biodiversity; and
3. Promote equitable access and a sustainable and inclusive biodiversity-based economy.

The PBSAP therefore aims to protect the diversity of ecosystems, habitats, populations, species and genetic diversity. Areas that are protected should be representative of all these levels of biodiversity and should encompass all environments as well as ensure ecosystem processes are maintained and are resilient in the face of climate change and variability. Once finalised the PBSAP indicators will be reported on, and this will be followed by an implementation plan.

The Eco-Invest project (a biodiversity economy strategy and programme which falls under the PBSAP) is linked to reducing the risks of fire and floods as well as water supply stress. This is being done through investing in natural capital to restore degraded ecosystems, allowing these ecosystems to return to delivering ecosystem goods and services such as flood water attenuation, which will increase the Western Cape's natural systems' resilience to climate change impacts.

WETLAND REHABILITATION

The Eco-Invest project advocates, inter alia, investing in maintaining and restoring ecosystem services such as wetlands. In the Western Cape wetland rehabilitation is often done by the Working for Wetlands programme, and Table 25 gives an indication of how many wetlands were rehabilitated in the Western Cape over the last three financial years by this programme⁹⁶.

TABLE 26. NUMBER OF WETLANDS REHABILITATED IN THE WESTERN CAPE, 2013 - 2016⁹⁷

YEAR	NUMBER OF WETLANDS REHABILITATED
2013/14	20
2014/15	29
2015/16	25

Climate change response that relates to improving the ability of biodiversity and EGS to lend our society the resilience to respond to climate change has been quite well addressed in the Western Cape to date. What needs further maturing is the use of ecosystems and biodiversity as buffers and in providing resilience to built infrastructure, towns, settlements, and to agriculture and key resources (water, food, energy, transport etc.).

⁹⁶It should be noted that there are other programmes that focus on wetlands in the Western Cape; in this case Working for Wetlands numbers are readily available.

⁹⁷H. Nieuwoudt, SANBI, pers. Communication.

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

- Better data sharing is needed between government entities such as WCG: EADP, SANBI and CapeNature, as well as between government and the private sector, to facilitate the tracking of biodiversity and EGS-related indicators.
- Due to the wide range of stakeholders and entities involved in alien clearing, finding comprehensive information on the numbers/hectares of aliens cleared is problematic. Alien invasives are covered in this report under the water section.
- Informally protected areas are hard to track, as the data is often patchy or outdated.
- There is a need to set fact-based climate change targets for this focus area.
- The data indicates that only very small areas of the climate change corridors are protected - there is therefore a big need to expand the conservation estate within these corridors.
- Local community stewardship over corridors and unprotected areas should be promoted.

COASTAL AND ESTUARY MANAGEMENT



The current WCCCRS priority areas for addressing biodiversity and ecosystem goods and services in the Western Cape in a changing climate include:

1. Establishment of coastal risk overlays and coastal management lines;
2. Research best practice regarding responding to repeated coastal inundation in high risk areas;
3. Protecting and rehabilitating existing dune fields as coastal buffers / ecological infrastructure;
4. Monitor possible linkages between climate change and fisheries industry; and
5. Ensure Estuary Management Plans take cognisance of climate change.

TABLE 27. BIODIVERSITY AND ECOSYSTEM GOODS AND SERVICES INDICATORS FOR THE WCCCRS

HIGH LEVEL CATEGORY	INDICATOR	DATA	
Coastal Management	Number of Coastal municipalities using coastal management lines and coastal risk overlays in development planning ⁹⁸ (out of 14 coastal municipalities)	Coastal management lines determined	9
		Coastal risk overlays determined	9
		Coastal management lines and coastal risk overlays endorsed by MEC	0
		Coastal Management lines and coastal risk overlays incorporated into municipal zoning schemes	1
Estuary Management	Number of Estuary Management Plans that adequately include climate change risks and responses (out of 16 existing plans) ⁹⁹	Climate change not mentioned at all	3
		Climate change mentioned briefly	4
		Potential impacts of climate change on estuary discussed	5
		Management actions in response to climate change identified (excluding research and monitoring)	4

TABLE 28. ADDITIONAL HIGH LEVEL COASTAL & ESTUARY INDICATORS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Estuary Management	State of estuaries	Most recent data from NBA 2011 ¹⁰⁰ : A: Unmodified, natural: 9% B: Largely natural with few modifications: 30% C: Moderately modified: 21% D: Largely modified: 21% E: Seriously modified: 15% F: Critically/Extremely modified: 4%
Coastal Management	% of Western Cape coastline protected by Marine Protected Areas (MPAs)	21.2% (2015) ¹⁰¹

⁹⁸ Zain Jumat, DEA&DP: Coastal Impact Management Sub-Directorate.

⁹⁹ DEA&DP: Climate Change Directorate.

¹⁰⁰ Van Niekerk, L. and Turpie, J.K. (eds) 2012. South African National Biodiversity Assessment 2011: Technical Report. Volume 3: Estuary Component. CSIR Report Number CSIR/NRE/ECOS/ER/2011/0045/B. Council for Scientific and Industrial Research, Stellenbosch.

¹⁰¹ DEA&DP: Spatial Information Management.

Climate change will likely lead to increased frequencies of disasters in coastal areas, which will lead to major economic losses; for example, Cartwright (2008)¹⁰² estimated that storm surges enhanced by sea level rise could cost the City of Cape Town between R5 billion to R20 billion in the next 25 years¹⁰³.

According to the National Coastal Management Programme (NCMP 2014), climate change results in environmental changes in the coastal zone such as:

- Changes in ocean circulation patterns;
- Sea level rise and increased storminess;
- Changes in temperatures from both the land and sea;
- Changes in precipitation and runoff;
- Changes in pH (referred to as ocean acidification); and
- Changes in wind regimes.

As a result of these impacts it is therefore important that climate change, and particularly the above-mentioned effects, be integrated into ocean and coastal spatial planning. As part of this DEA, will develop conditions of use for the coastal zone, including a national coastal risk and vulnerability assessment. These conditions of use will provide guidance for mitigation and adaptation to climate change in the coastal zone (DEA: Oceans and coasts, in progress)¹⁰⁴.

The NCMP identified nine key priorities for coastal management in South Africa, of which priority one is “*Effective planning for coastal vulnerability to global change (including climate change)*”. The programme also indicates that national government is in the process of preparing a coastal hazard zone index and demarcate coastal hazard zones (including impacts from climate change) by March 2015.

South Africa’s primary piece of legislation dealing with the coast is the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) as amended by the National Environmental Management: Integrated Coastal Management Act, 2014 (Act No. 36 of 2014). The act aims to provide integrated management of South Africa’s coastline and ensuring the sustainable use of the coast’s natural resources, while discouraging inappropriate development.

The importance of correctly managing our coastal areas, as well as the economic opportunities that the coast offers, is enjoying increasing attention, as evidenced by the recent focus by national government on the coastal economy in the form of Phase 1 of Operation Phakisa, undertaken by the Presidency and DEA in 2014.

The WCG is responding to the need for responsible coastal and estuary management in several ways. The 2013 State of the Environment Outlook Report (SOEOR) included a chapter on oceans and coasts, which concluded that the quality of South Africa’s oceans and coasts are

¹⁰²Cartwright, A., Brundrit, G. B. and Fairhurst, L. (2008). Global climate change and adaptation – A sea-level rise risk assessment. Phase four: Adaptation and risk mitigation measures for the City of Cape Town. Prepared for the City of Cape Town by LaquaR Consultants CC, 42 pp.

¹⁰³Umvoto Africa. (2010). Sea Level Rise and Flood Risk Assessment for a Select Disaster Prone Area Along the Western Cape Coast. Phase 1 Report: Eden District Municipality Sea Level Rise and Flood Risk Literature Review. Prepared by Umvoto Africa (Pty) Ltd for the Provincial Government of the Western Cape Department of Environmental Affairs and Development Planning: Strategic Environmental Management (May 2010).

¹⁰⁴National Coastal Management Programme (2014).

declining due to environmental impacts. It also pointed out that effectively responding to this decline is dependent on data and information around coastal indicators being available. The coastal SOEOR indicators are given in Annex 3.

Although climate change is not often mentioned as a direct threat to estuaries, there are in fact many climate change impacts which may affect estuaries significantly. These include reduced/increased freshwater flow, sea level rise, increased storm activity and decreased rainfall. These changes may result in reductions in estuarine nursery habitat, or cause changes in how often mouths open¹⁰⁵. Longer periods of drought and intense flooding events will also affect salinity levels and ecological functioning of estuaries.

STATE OF ESTUARIES

As healthy estuaries are more resilient to the effects of climate change, the state of estuaries is considered to be an important indicator that we can use to track our climate change adaptation response. However, determining the state of estuaries is somewhat problematic. A thorough review was done as part of the National Biodiversity Assessment (NBA 2011, see Table 28 and Figure 17; this data was also used in the SOEOR 2013), but since then no further extensive analysis has been done. Although monitoring around estuaries is being done by DWS, NGOs and municipalities (with the latter submitting reports to the Municipal Coastal Committees), the information is too high level to be used to generate a rigorous assessment of the state of the estuary in question. Monitoring has also not been standardised, with different entities tracking different indicators. At this stage the only regular rigorous review of the state of estuaries appears to be occurring in the NBAs; the next NBA is scheduled to be released in 2018/19 financial year. However, the DEA&DP will be developing a Western Cape State of the Coast report in 2016/17, which could be a useful information source for the state of estuaries, particularly if it is repeated on a regular basis.

TABLE 29. ECOLOGICAL MANAGEMENT CATEGORY CLASSIFICATIONS FOR ESTUARIES (DWAF 2008)

ECOLOGICAL CATEGORY DESCRIPTION	
A	Unmodified, natural.
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions and processes are essentially unchanged
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions and processes are still predominantly unchanged
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions and processes have occurred
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions and processes are extensive
F	Critically/Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions and processes have been destroyed and the changes are irreversible

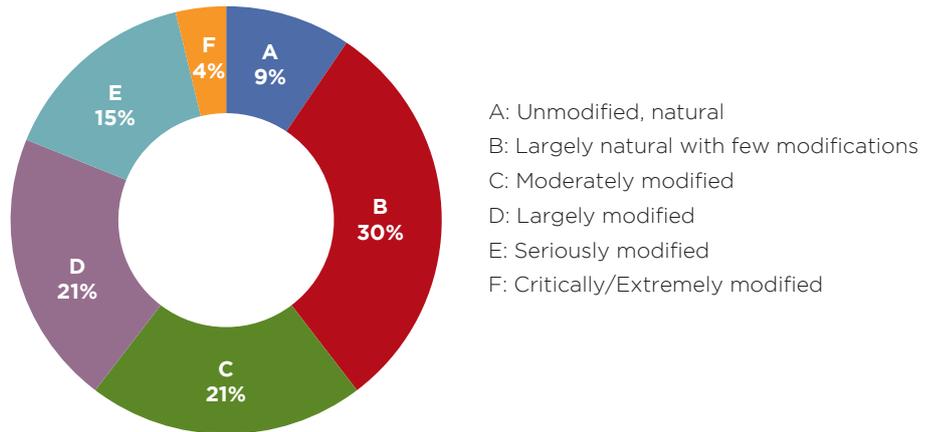


FIGURE 17. Percentage of the Western Cape estuaries classified under the various ecological rating categories (NBA 2011)

SEA LEVEL RISE AND STORM SURGES

Increased sea storm surges due to more extreme weather coupled with sea level rise in particular have a great potential to impact our coastal developments. This has been felt in the City of Cape Town in the last few years, with some coastal businesses and infrastructure being inundated on a regular basis, causing repeated damage. High intensity storms and high water events also have the potential to impact on estuarine, inshore and offshore fisheries¹⁰⁷. The City of Cape Town is in the process of setting up a monitoring programme to track what combinations of environmental conditions lead to damage to infrastructure (such as swell direction and height, wind speed and direction, etc.). This should in future give an indication of which climate change related factors have the potential to threaten critical infrastructure.

In 2010, the WCG commissioned sea level rise studies for all the coastal Districts in the province, which included a review of sea level rise science and literature for South Africa and the Western Cape, a sea level rise and flood inundation Geographic Information System (GIS) model, as well as a sea level rise and flooding hazard risk assessment for the coastline.

COASTAL MANAGEMENT LINES AND COASTAL RISK OVERLAYS IN COASTAL MUNICIPAL DEVELOPMENT PLANNING

In 2011, the DEA&DP commissioned a series of studies to determine coastal setback / management lines for all District Municipalities in the Western Cape. Table 29 gives an indication of which coastal municipalities have had coastal management lines (9 municipalities in total) and coastal risk overlays (9 in total) determined. So far none of these have been adopted by the MEC for Local Government, Environmental Affairs and Development Planning; however the process for adoption has been initiated. Until the coastal management lines and coastal risk overlays have been adopted the municipalities may use them to inform their development decisions, but they are not necessarily compelled to do so.

¹⁰⁷Department of Environmental Affairs. 2013. Long-Term Adaptation Scenarios Flagship Research Programme (LTAS) for South Africa. Summary for Policy-Makers. Pretoria, South Africa.

TABLE 30. PROGRESS AND APPROVAL STATUS OF COASTAL MANAGEMENT LINES AND COASTAL RISK OVERLAYS IN THE WESTERN CAPE (DATA SOURCE: COASTAL IMPACT MANAGEMENT COMPONENT, DEA&DP)

COASTAL MANAGEMENT LINES DETERMINED	COASTAL RISK OVERLAYS DETERMINED	COASTAL MANAGEMENT LINES AND COASTAL RISK OVERLAYS ADOPTED BY MEC	COASTAL MANAGEMENT LINES AND COASTAL RISK OVERLAYS INCORPORATED INTO MUNICIPAL ZONING SCHEMES
City of Cape Town West Coast District <ul style="list-style-type: none"> • Matzikama • Cederberg • Bergrivier • Saldanha Bay • Swartland Overberg District <ul style="list-style-type: none"> • Overstrand • Cape Agulhas • Swellendam 	City of Cape Town (for specifically identified areas) West Coast District <ul style="list-style-type: none"> • Matzikama • Cederberg • Bergrivier • Saldanha Bay • Swartland Overberg District <ul style="list-style-type: none"> • Overstrand • Cape Agulhas • Swellendam 	None	City of Cape Town - coastal urban edge included in SDF

The 2004 Western Cape Coastal Management Plan is currently under review, and will be replaced by the Western Cape (WC) Coastal Management Programme in 2016. Along with guiding coastal management in the Western Cape, the plan also focuses on growing the blue¹⁰⁸ and green economy through unlocking the economic potential of our coastal assets. It will contribute directly to enabling a resilient, sustainable, quality and inclusive living environment through improved coastal spatial and development planning, access, protection and Local Government support.

Of the nine Priority Areas of the plan, Priority Area 4 focusses on “*climate change, dynamic coastal processes and building resilient communities*”, with the goal of promoting resilience to the effects of dynamic coastal processes, environmental hazards and natural disasters. Some of the outputs of this priority area will include a coastal vulnerability analysis for the Western Cape, a Western Cape Coastal Regional Plan (with responses to increase coastal resilience), and a Provincial Coastal Protocol for assessment and response for coastal vulnerability, risk and damage.

The Programme also has a priority area dedicated to Estuary Management. This focusses on the requirements of the National Estuarine Management Protocol, with the goal of co-ordinating and integrating estuarine management to optimise the ecological, social and economic value of these systems on an equitable and sustainable basis. It will lead to the development of a Provincial Estuarine Management Framework and Implementation Strategy as part of a dedicated Provincial Estuarine Management Programme. Among other outcomes, this will see 33 EMPs and 10 mouth management plans which include climate change considerations approved in the near future.

¹⁰⁸In this context the blue economy refers to the development of South Africa's marine resources.

INCLUSION OF CLIMATE CHANGE RISKS AND RESPONSES IN ESTUARY MANAGEMENT PLANS

Of the 62 estuaries in the province, 16¹⁰⁹ currently have draft Estuary Management Plans (EMPs) that are awaiting final approval (these are being implemented in the interim). These EMPs were developed by the Cape Action for People and the Environment (C.A.P.E) programme, and will be updated as part of the above-mentioned Provincial Estuarine Management Framework and Implementation Strategy. Recently 25 draft EMPs from all over the country were reviewed by DEA in terms of the National Estuarine Management Protocol, which included the 16 draft Western Cape EMPs. This resulted in a review report¹¹⁰ which indicated the suitability for approval for each of the reviewed draft EMPs, as well as various recommendations for changes and additions. One of the general findings of the review was that most of the draft EMPs did not address climate change or sea level rise. The degree of consideration of climate change and sea level rise in the Western Cape draft EMPs is given in Figure 18.

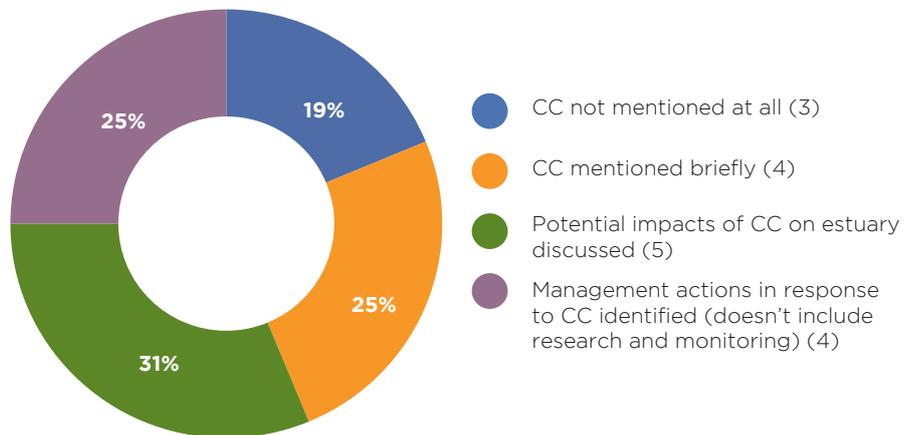


FIGURE 18. Degree of inclusion of Climate Change (CC) and sea level rise issues in Western Cape Estuary Management Plans (note that many of these plans are still in draft form awaiting final approval)

Both the Western Cape Protected Area Expansion Strategy (PAES 2016) as well as the WC Coastal Management Programme supports the expansion of Marina Protected Areas (MPAs) in the Western Cape as part of Operation Phakisa¹¹¹, with the expansion and effective management of a system of coastal protected areas being one of the goals of Priority Area 6 (*Natural and cultural resource management*) of the WC Coastal Management Programme.

¹⁰⁹See annex 4 for a complete list.

¹¹⁰Department of Environmental Affairs (2014) National Estuarine Management Protocol. Review of Existing Estuarine Management Plans 2007-2014. Cape Town.

¹¹¹A national government initiative to fast track the implementation of solutions on critical development issues.

WESTERN CAPE MARINE PROTECTED AREAS

As of 2015, 369 km (or 21.2%) of the Western Cape's 1 742 km coastline is protected by MPAs. This includes the coastlines of islands that fall within MPAs, but excludes some Marine Nature Reserves that still need to be added¹¹². Although there haven't been large changes to these areas in the last 5 years, they are soon set to increase given the goals of Operation Phakisa as well as the planned MPA expansion outputs from the WC Coastal Management Programme, with additional draft MPAs published for public comment in February 2016 by DEA.

An area of emerging need of work is the fisheries sector, as climate change is likely to affect the productivity and diversity of South Africa's fisheries. This could result in significant adverse impacts on subsistence fishing livelihoods as well as commercial and recreational industries; this is worsened by the fact that our fish stocks are overexploited, which increases their vulnerability to climate change. Already shifts have been noticed in the spatial distribution of some marine species in our waters. By reducing overfishing, habitat degradation, pollution and other anthropogenic factors, we can improve our fisheries management to make the sector more sustainable and more adaptable to climate change⁹⁸. Monitoring of these areas is essential to achieve this, and the DEA&DP has been engaging with national Department of Agriculture, Forestry and Fisheries (DAFF) on the development of their fisheries climate change adaptation plan.

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

- Case studies and cost benefit analyses on optimal approaches to coastal protection should be developed for the Western Cape.
- Fact-based climate change targets for this focus area need to be set out.
- A better understanding of the fisheries sector and the impact of climate change on the sector in the Western Cape is required.
- There are challenges around how regularly datasets are updated – e.g. that the state of estuaries will only be updated approximately every 7 years.
- Monitoring standards need to be implemented for estuaries, possibly through the incorporation of a monitoring and evaluation component in all EMPs. Thus, the state of the each estuary should be monitored on a regular basis.

¹¹²H.F. Verwoerd Marine Reserve (Betty's Bay), Millers Point Nature Reserve (Simon's Town), Knysna National Lake Area and marine reserves that for part of national parks (West Coast National Park, Wilderness National Park and Tsitsikamma National Park).



HEALTHY COMMUNITIES

The current WCCCRS covers the following in this focus area of Healthy Communities:

- i) Monitoring health trends in relation to climate trends, including the linkages between human health and climate change in the Western Cape context.

[Infrastructure and energy efficiency in public buildings, which includes hospitals and clinics is covered under the Energy section]

There is currently no indicator for tracking climate change and health research in the Western Cape context, because the area of research is particularly new, and because there has not yet been a concerted effort to analyse the broader research that might be underway. There is a variety of research areas being undertaken by institutions within the Cape Higher Education Consortium (CHEC) which is further discussed in the Cross-Cutting Research section of this report. Two key research areas were mentioned by CHEC research institutes, namely:

- University of Cape Town (UCT) Centre for Environmental and Occupational Health Research, Projects “Climate change, variability, pest infestation and vector borne disease”, “Climate change and implications for endocrine disrupting chemicals”, “Climate change, heat and workers” and air pollution related research; and
- Stellenbosch University (SU) Invasion Biology, Project on the effects of climate change on disease vectors and invasive fauna and flora.

TABLE 31. HEALTH INDICATORS FOR THE WCCCRS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Provincial hospitals uptake of greening	Number of provincial hospitals that have joined the Global Green and Healthy Hospitals Network (GGHHN)	6 (out of 52) (2015 data)

TABLE 32. ADDITIONAL HIGH LEVEL HEALTH INDICATORS

HIGH LEVEL CATEGORY	INDICATOR	DATA
Household Food Security	% households with measure of food insecurity	22.70% ¹³
Household Sanitation	% households with access to sanitation	94.8% ¹⁴

The Health sector is increasingly gaining more prominence in dialogues and research on the impacts of climate change globally. This includes a variety of concerning trends including inter alia: i) the links between climate change and potential outbreaks of diseases such as Ebola Virus Disease (EVD), and Zika Virus most recently; ii) link between climate

¹³Western Cape Government Green Economy Report 2014 [2013 data].

¹⁴Western Cape Government Green Economy Report 2014 [2013 data].

change and malnutrition; iii) increasing incidence and occurrence of disease such as Cholera related both to changing climate and decline in infrastructure and ability to cope with increasing urban populations; and iv) the unknown psychological impacts of climate change on human mental wellbeing.

The Western Cape does have in a number of instances progressive performing health statistics. For example: i) life expectancy at birth is 66 years, 68 years for women and 64 years for men, which is above the figures for the country as a whole; ii) the infant mortality rate is 19.1 compared to 27 nationally; and iii) the maternity mortality ratio is 78 as compared to 269 for South Africa¹¹⁵. However, the Western Cape does already have large vulnerable communities with a high underlying disease burden (i.e. HIV/AIDS¹¹⁶ (7.8% in age 15 -49 years - 2012) and Tuberculosis (the highest in the country with 703 cases per 100,000)¹¹⁷. Climate related hazards such as extreme events characterised by floods and high winds, heat waves and cold snaps will result in impacts such as heat stress, an increase in incidence of communicable diseases, and potential range expansion of disease vectors.

The biggest impact is likely to be on the poor, environmental migrants, vulnerable children, the frail and the elderly.

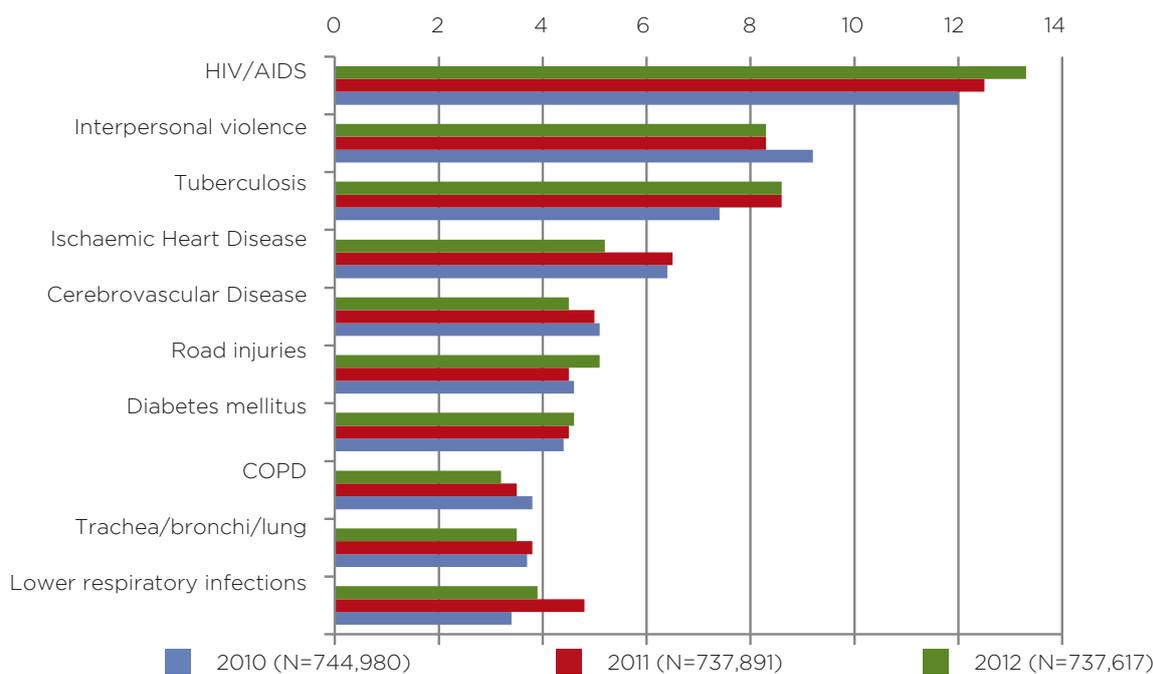


FIGURE 19. Leading causes of death, measured in years of potential life list (TLL), for all persons in Western Cape, 2010 – 2012

A large contributing factor to increased resilience in health and the ability to cope with climate impacts is related to the underlying vulnerability and state of health services infrastructure, community infrastructure such as clean water and sanitation and access to facilities, health and medical staff. The baseline resilience of the Western Cape is relatively

¹¹⁵Western Cape Department of Health, Annual Report 2014/15.

¹¹⁶The Western Cape Mortality Surveillance Report for 2012/1 shows that HIV and TB remain the leading single causes of premature mortality in the Province; however, premature mortality due to HIV shows a decrease in 2012 compared to 2011, a trend noted in the previous annual report. Premature mortality due to some (e.g. cerebrovascular disease) but not all (e.g. not in ischaemic heart disease or diabetes mellitus) chronic diseases continued to increase from 2011 to 2012, after having increased the previous year. [From WCGHealth AR 2014/15]

¹¹⁷Western Cape Department of Health, Annual Report 2014/15.

high; although with increasing population sizes particularly in lower income groups do result in an ongoing backlog of service delivery.

The current focus on health care, emergency health response and preparedness in the Western Cape to Climate Change risks is still in a research and preparation phase. There is currently a low awareness of impacts of climate change on inter alia: infectious diseases, violence and injury, mental health, chronic diseases, malnutrition, women's and reproductive health, child health, and occupational health. This includes impacts such as heat stress, and extreme events directly on human health and well-being (including psychological impacts). Furthermore, to date there is limited preparation and planning in place to knock-on impacts via specific vector pathways.

Nationally in South Africa, there is a National Climate Change and Health Adaptation Plan 2012 -2016 which has started to guide the needs and responses of the health sector. Other key strategic research policy focused initiatives in South Africa have also contributed to the evidence base for health, such as the focus on 'Climate Change and Human Health' in Phase 1 of the national Long Term Adaptation Scenarios. This Key piece of work has also identified that monitoring of health trends in relation to climate trends is the critical action required across the country. Within the Western Cape, the HealthCare 2030 Strategy guides the Health sector of the Western Cape (See Box 11). There is currently no climate change response plan in place for Health in the Western Cape (This would ideally include specific hazard response plans: such as heatwaves, cold snaps, severe storms, flooding etc.). Although there is a Climate Change Adaptation Plan of Action (CAPA) for the health sector in the City of Cape Town which was drafted in September 2011, following a series of workshops and interviews with key informants across the City (City of Cape Town 2011). The WCG: Department of Health has recently become a member of the Global Green and Healthy Hospitals Network (GGHHN) and is a signatory to the Kolkata Call to Action.

BOX 12 THE WC HEALTHCARE 2030 STRATEGY

The health service needs to be in a state of readiness to address the public health consequences of climate change. This will include improved surveillance and disease outbreak management capacity, better disaster management and rescue responsiveness in collaboration with other departments and strengthened emergency services within health.

The department will put in place tools to measure its own contribution to GHG emissions, set targets and implement cost-effective mitigation measures to systematically reduce its GHG contributions. This will include a range of interventions from better infrastructure design to more environmentally friendly operational policies such as the Green Procurement Policy of the WCG. The four focus mitigation areas are currently water usage, electricity consumption, waste management and distances travelled.

The department has created a climate change committee, convened by a senior manager, to systematically start to address both the mitigation and adaptation aspects. Work is currently in its infancy. Disaster preparedness in the department is being systematically supported by the emergency medical services. The committee will also be the liaison point for engaging with other sectors and spheres of government in this regard.

Continued on page 85 >

< Continued from page 84

Khayelitsha and Lentegeur hospitals have been identified as flagship projects as part of the Premier's 100% Green campaign. Local initiatives by institutions in the department are being encouraged and the expertise, technical knowledge and research within the Higher Education Institutions (HEIs) are being harnessed by the department.

Various coordinating initiatives are underway and in development, for example, there is a National Climate Change & Health Steering Committee. Institutionally the WCG; DoH established a Western Cape Climate Change and Health Committee. It includes both internal and external stakeholders and includes ongoing guidance and consistent support from the EADP Climate Change Directorate. The committee focuses on both climate change mitigation and adaptation issues related to health, with an increasing focus towards adaptation and resilience. Key collaborations and partnerships are critical for health and climate change, such as enhancing partnerships with national structures, such as the Epidemiology and Surveillance Directorate under the WCG:DoH to monitor these trends in the Western Cape.

Whilst the research required on climate change and health impacts in the Western Cape is in its nascent stages, there are some research projects and programmes underway that will continue to provide a sound basis upon which to build our knowledge.

BOX 13 AIR QUALITY AND CLIMATE CHANGE

Continued reduction in air pollution and GHG emissions are essential, as they pose serious threats to both people's health and the environment. Implementation of air quality and climate change policies can provide mutual benefits contributing to clean air and reduction in global warming.

Furthermore, air pollution and climate change influence each other through complex interactions in the atmosphere. Increasing levels of GHGs alter the energy balance between the atmosphere and the earth's surface which, in turn, can lead to temperature changes that alter the chemical composition of the atmosphere. Direct emissions of air pollutants (e.g. black carbon) or those formed from emissions such as sulphate and ozone can also influence this energy balance. Thus, climate change and air quality management have consequences for each other. Linkages with air quality management was made with the energy focus area through GHG reductions as well as a contributor to healthy communities. Work is underway to align climate change priorities with goals and objectives of the Western Cape Air Quality Management Plan, which is currently being updated. Goal 4 of the Air Quality Management Plan is focussed on supporting climate change programmes that include the reduction of GHG emissions.

The WCG: EADP is currently developing an airshed planning tool to assist air quality management decision-making that will contribute to reductions in priority air pollutants and GHG emissions. WCG: EADP is also conducting a Human Health Risk Assessment (HHRA) which aims to determine the potential for health effects from ambient air pollution to pre-identified communities in the Province. The information will help the Department in making informed decisions on air quality management in these areas.

OPPORTUNITIES, GAPS AND RECOMMENDATIONS

- Develop a Climate Change Response Plan for the Health sector in the Western Cape aligned with the national responses.
- Future iterations of the WCCCRS and Implementation Plan will enhance the health focus, and in synergy with this more sophisticated groups of indicators might be tracked. Indicators may need to be linked cross-sectorally, e.g. days of absenteeism from schools may provide data for diseases, but this will require tight coordination across multiple levels.
- Collaborate across sectors for specific groups of vulnerable people who will be impacted by specific climate change impacts. For example for occupational health of agri workers who work outdoors may require specific plans for coping with heat waves, as has been identified in the Agriculture response strategy.
- Co-ordinate integrated plans and health surveillance with the Western Cape Disaster Management Centre.
- Continue to partner with research organisations and entities to undertake critical research and surveillance and monitoring as identified in the Health Climate Change Response Plan. This could include a range of specific interlinked data collection activities at different levels (from clinic to provincial hospital). It should include the development of burden of disease indicators in order to monitor the impact of climate change and should also enhance systems developed to report on the impact of climate related extreme events on health.

KNOWLEDGE MANAGEMENT, COMMUNICATIONS & RESEARCH



CLIMATE CHANGE DATABASES

As part of monitoring the overall Western Cape response to climate change, the DEA&DP maintains an online database of climate change response projects (both public and private sector) that have either been completed or are currently running in the Western Cape. Approximately 200 projects have been catalogued, and are categorised based on the nine focus areas identified in the WCCCRS. The projects information will eventually feed into national government's efforts to track South Africa's response to climate change. Additionally, the database has the potential to facilitate interactions between projects to take advantage of any opportunities and synergies that may have been missed by making project managers aware of what other climate change response-related projects are occurring that they can link with. The database will help to disseminate knowledge and case studies on climate change response, as well as preventing project duplication, as well as raising general awareness on what the Western Cape is doing around climate change.

RESEARCH AS A CROSS-CUTTING THEME

Research is a cross-cutting theme throughout all the sectors that have a role in mitigating climate change and in adapting to the impacts of climate change. In order to gain a more comprehensive and up to date understanding of the type of research being undertaken on climate change in the Western Cape, WCG:DEA&DP commissioned a research assessment in 2015 of the Cape Higher Education Consortium (CHEC), which consists of: the Cape Peninsula University of Technology (CPUT), University of Cape Town (UCT), Stellenbosch University (SU), and University of the Western Cape (UWC). The report was titled "Trends in Climate Change, Sustainability and Green Economy Research at CHEC Institutions" and is referred to below as 'the CHEC report'. Although this only covers the locally available research institutions, and not those from elsewhere in the country or overseas, it does provide some useful insights into the state of climate change related research in the province.

The research projects and programmes contained in the CHEC report were reviewed in order to identify those that seemed to have the greatest links with the focus areas of the Western Cape Climate Change Response Strategy, taking into consideration that the research descriptions in the report were very brief and did not explain the research aims and scope in detail.

Some of the following were conclusions derived from the report on climate change research areas that are relevant and applicable to the priority areas currently covered by the WCCCRS and that require more attention for the Western Cape. It is likely there may be other research institutions covering these topics, and further that there may be

additional gaps that will be identified in the coming years. For now this provides some insight for academia and research institutions to include in their areas of interest.

1. Technology, solutions and appropriate responses to climate change (both mitigation and adaptation) largely exist already. The areas of research required largely fall into: governance, behaviour change, transformative approaches, planning, decision-making approaches, power and influence; economic cases and evidence; communications and knowledge brokering. And above all, the major problem is the transfer of information and knowledge from research outputs to decision makers.
2. Many of the research projects have a specific focus, e.g. they focus on one aspect of climate change adaptation. There is a need for a research/information “map” that identifies the gaps and steers further research towards completing the whole picture (e.g. full climate change response of mitigation and adaptation).
3. Specific areas that need more research/focus or a shift in the type of approach are described below:
 - a. Urban infrastructure and the risk of economic costs of climate change to this infrastructure – there was no research identified dealing with this area which can ultimately have the highest economic cost to the province;
 - b. There is not much research being done on transport, and this is one of the sectors that will have the higher potential climate change costs and risks. Linked to this, more research is needed on reducing GHG emissions from transport (highest emission sector in the province) – innovative applied research is required;
 - c. The theme of climate change and health needs more attention. Some work is starting but it is only in its nascent stages. There is not much research evident in terms of climate change and psychological impacts on the general public – this is an emerging field of work globally. A comprehensive climate risk and vulnerability analysis is needed in the province and a strategy response developed across a wide range of vectors and diseases. This is linked to disaster risk reduction as well;
 - d. Multi-sectoral and systems approaches are needed to solve “wicked” problems – there are a few projects doing applied research in this field within local governments but we need this i) as a provincial project and research area; and ii) for more local governments, not just the City of Cape Town (CoCT);
 - e. Research on Climate Justice and the legal aspects of climate change is not covered. What are the legal implications for subnational governments not taking appropriate action on climate change when the science of climate change available;
 - f. Governance aspects – more research is needed on inclusive bottom up approaches;
 - g. Research on municipal financial models and reform to deal with climate change effects is needed; and
 - h. Research on climate resilient procurement is needed.

ANNEX 1: LIST OF CONTRIBUTING STAKEHOLDERS TO THIS REPORT



ORGANISATION	CONTRIBUTORS
WCG: DEA&DP: Waste Management	Eddie Hanekom; August Hoon; Lance McBain-Charles
WCG: DEA&DP: Biodiversity	Albert Ackhurst
WCG: DEA&DP: Coastal Management	Mellisa Naiker; Nyanisa Tshaya; Caren George
WCG: DEA&DP: Coastal Impact Management	leptieshaam Bekko
WCG: Department of the Premier	Hildegard Fast
WCG: DEA&DP: Berg River Improvement Project	Jason Mingo
WCG: DEA&DP: Pollution Prevention & Regulatory Services	Cathy War
WCG: DEA&DP: Pollution And Chemicals Management	Wilna Kloppers
WCG: Department of Local Government: Risk Reduction Planning	Nabeel Rylands
WCG: Department of Health: Infrastructure Planning	Chris Maud
WCG: Department of Agriculture	Ilse Trautmann
GreenCape	Jack Radmore
CapeNature	Pierre de Villiers; Marienne de Villiers, Ruida Stanvliet, Genevieve Pence, Jenifer Gouza
City of Cape Town	Darryl Colenbrander
University of Cape Town	James Irlam
National Cleaner Production Centre	Ajay Tikram



ANNEX 2: ACTUAL OBSERVED CLIMATE IMPACTS

The following are some recent observed trends in the Western Cape:

CLIMATE VARIABLE	OBSERVED TRENDS	OUTLOOK AND COMMENTS
Temperature	<p>General trend of rising temperatures, including both minimum and maximum temperatures.</p> <p>Increasing temperatures is resulting in a trend in increased evapotranspiration (this in particular can drive a shift in state to droughts, and severe impacts on agriculture).</p> <p>Increased temperatures and increased evapotranspiration result in dry soils and vegetation which becomes more fire-prone – March 3rd 2015 was the highest temperature ever recorded (in 100 years) in Cape Town at 42°C. This coincided with severe fires.</p>	<p>There has been a decrease in the number of very cold days which creates the cold (or chill) units required for deciduous fruit cultivars to grow.</p> <p>Number and intensity of fires seem to be increasing. Disaster funds for fires will need to increase as well, but more importantly proactive protection of ecosystems and water is the required long term response.</p>
Precipitation (Rain, snow)	<p>Reduction in rain days in autumn and summer especially on the Southern Coast.</p> <p>Evidence of a trend in increasing severity of rainfall events (i.e. more rain falls in a shorter time).</p> <p>Winter rainfall season starting later each year.</p> <p>Anecdotal information of reduction of winter snow in Karoo – may result in decreased groundwater recharge. Current status unknown.</p>	<p>CCT already responding to this trend with increased flood preparedness plans in winter, as well as increased standard requirements for storm water flows in infrastructure.</p>
Wind	<p>Wind velocity expected to increase, with stronger South Easters. Impacts currently unknown.</p>	<p>Impacts on tourism: e.g. Table Mountain cable car operations, Robben island ferry operations, Beach usability etc.</p>
Sea level rise	<p>Sea level has been rising at the same rate as global trends. See discussion on 'sea storm surges' below.</p>	<p>There is global concern that previous estimates of the rates of sea level rise may have been too optimistic, and that decision makers need to be aware that worst case scenarios in this century may be possible.</p>
Ocean temperature	<p>The Agulhas current has warmed by 1.5°C since 1980. The impact of global warming and sea-level rise has already brought changes in the distributional range of fish and other marine species. Climate change is also responsible for shifts in the distribution of the West Coast rock lobster. However, the full understanding of these changes is complex and cannot necessarily all be attributed to a changing climate¹¹⁸.</p>	<p>Impacts of shifting marine resources have implications for social and economic fabric of coastal communities.</p>
Ocean Acidification ¹¹⁹	<p>Ocean acidification would have severe impacts on most ocean life. Currently the ocean has already acidified by 0.1 pH points as a global average (this varies from region to region).</p>	<p>Current impacts not well described.</p>

¹¹⁸SAEON. 2011 Observations in Environmental Change in South Africa.

¹¹⁹As the ocean absorbs CO₂ its PH changes.

EXTREME EVENTS (THESE CAN RESULT AND BE RELATED TO ONE OR MORE OF THE ABOVE CLIMATE VARIABLES)

Between 2003 and 2008 direct damage related to climate events in the Western Cape amounted to approximately R3 Billion; particularly from floods and droughts (Eden District and Central Karoo droughts of 2009/10 and floods of 2011 etc.). Newer data to 2015 is likely to be higher.*

Floods / Droughts	Numerous flood and drought events have occurred in the Western Cape in the past decades with increasing frequency. It is difficult to determine if these are all attributable to a changing climate, but this is likely given similar trends globally.	
Sea Storm Surges (big storm events)	In the past 15 years various big storm events have caused infrastructure damage along the Western Cape coastline. Studies reflect sea level has risen on the Western Cape coastline in accordance with global trends. Most impacts are due to inappropriate coastal development.	Coastal municipalities potentially have a big role to play here. Insurance companies are starting to withdraw from some vulnerable coastal areas.
Fire	Observed increased fire incidences ¹²⁰ and potential increase in extent and severity of fires. 2015 fires occurred in record breaking hot temperatures: The economic implications to the Tourism industry are unknown; the costs to Cape Nature and SANParks have not yet documented.	It is challenging to differentiate how much of the increase in fires and intensity is climate change related, but global trends indicate climate change has a role to play.
Hail	There is anecdotal evidence that more hail storms are occurring in new areas of the Western Cape, causing economic losses to agriculture (SmartAgri Status Quo Report).	The increased likelihood of hail storms is not well understood.

*Current disaster funding approaches are not sufficient for responding to climate change. These funds are generally reactive, and disaster funding is often utilised to rebuild the exact same infrastructure in the exact same places. In order to respond effectively and responsibly to climate change all departments need to integrate climate change into infrastructure build and planning, and to utilise standards appropriate for a changed climate regime.

¹²⁰<http://www.iol.co.za/news/south-africa/western-cape/cape-fire-insurance-firms-brace-for-claims-1.1827557#.VfnA8RGeDGc>



ANNEX 3: STATE OF ENVIRONMENT OUTLOOK INDICATORS (2013)

The State of Environment Outlook Report (2013) outlook indicator table is given below. This gives a general overview of the state of the environment in the Western Cape, and compliments the indicators covered in this document.

Arrows indicate the direction of the trend of the “state” of a sector – downward arrows indicate that the state of the sector in general is declining, upward arrow indicate that it is improving, etc.

TABLE A2: SUMMARY OF ENVIRONMENTAL INDICATORS REPORTED ON IN THE STATE OF ENVIRONMENT OUTLOOK REPORT (2013)

LAND	KEY POINTS	TREND	
Land cover	<ul style="list-style-type: none"> 4th largest province (10.6% of total) in South Africa 78% natural 22% transformed <ul style="list-style-type: none"> 18.7% agriculture 1% urban 0.7% forestry 0.7% degraded 	<i>Declining</i>	↓
Land capability	<ul style="list-style-type: none"> No high capability soils- vulnerable agriculture requiring high inputs 	<i>No change</i>	→
Land transformation	<ul style="list-style-type: none"> Intensification of urbanisation sprawl 1.6% more agriculture 	<i>Declining</i>	↓
Biodiversity & Ecosystem Health	Key points	Trend	
Alien invasive species	<ul style="list-style-type: none"> 291 invasive plant species Primary threat to indigenous fish 	<i>Declining</i>	↓
Biodiversity Priority Areas	<ul style="list-style-type: none"> Progress on expansion of conserved areas but only 2.3% of expansion qualifies as formal protection 	<i>High concern</i>	↓
Protected areas	<ul style="list-style-type: none"> Since 2002: <ul style="list-style-type: none"> 311,197ha formally protected (Only 2.4% of which are Critical Biodiversity Areas) 4,861ha biodiversity agreements 27,077ha conserved with no legal protection 	<i>Improving</i>	↑
Habitat fragmentation	The province contains 15 of the 17 highly fragmented vegetation types in the country	<i>Insufficient historical data</i>	↕
Vegetation types	Existing mapping is from the South African National Biodiversity Institute (SANBI)	<i>No change</i>	→
Threat status	<ul style="list-style-type: none"> Threatened species: <ul style="list-style-type: none"> 70% of freshwater fish (16 of 23 indigenous species under threat) 13% of plants (13,489 species total – 1,709 Threatened + 296 Critically Endangered + 575 Endangered + 801 Vulnerable; 68% of National Threatened species total; 2,984 additional species of concern; 21 species Extinct; 1,695 endemic to Western Cape) 10% of mammals 5% of reptiles 	<i>Insufficient historical data</i>	↕

- o 5% of birds
- o **Marine fish and invertebrates** – information not available, cartilaginous fishes are assumed most threatened with 4 of 35 species Critically Endangered
- Threatened terrestrial ecosystems:
 - o 21 critically endangered
 - o 14 endangered
 - o 23 vulnerable

Centres of endemism	<ul style="list-style-type: none"> • 96% of threatened species are endemic 	<i>High concern</i>	
Inland Water	Key points	Trend	
Water availability	<ul style="list-style-type: none"> • Water resource balance (2005): <ul style="list-style-type: none"> o Supply 2522 million cumec o Demand 2637 million cumec o Current deficit of 115 million cumec (was 90 in 2000) 	<i>Declining</i>	
Fitness for use	<ul style="list-style-type: none"> • River Health Water Quality assessment: <ul style="list-style-type: none"> o Overall – relatively good shape o 21% natural o 36% good o 34% fair o 9 % poor 	<i>Insufficient historical data</i>	
Freshwater ecosystem health	<ul style="list-style-type: none"> • River Health Ecstatus: <ul style="list-style-type: none"> o 6% natural o 30% good o 48% fair o 14% poor 	<i>Insufficient historical data</i>	
Oceans & Coasts	Key points	Trend	
Coastal water quality	<ul style="list-style-type: none"> • Blue Flag Beaches monitoring shows acceptable state 	<i>Improving</i>	
Estuary health	<ul style="list-style-type: none"> • Poor health, highly modified, poorly protected and highly threatened (Eden District is the exception to this) 	<i>High concern</i>	
Conservation areas	<ul style="list-style-type: none"> • 8 marine protected areas • Mixed results in terms of management 	<i>Improving</i>	
Marine area threats	<ul style="list-style-type: none"> • Critically endangered marine habitats: <ul style="list-style-type: none"> o West Coast nearshore o Eden and Overberg offshore areas o Continental shelf edge • Endangered habitats: <ul style="list-style-type: none"> o Langebaan o Cape Agulhas 	<i>High concern</i>	
Transformation	<ul style="list-style-type: none"> • Loss of threatened ecosystems along 14% of the coastline between 2001 and 2009 	<i>Declining</i>	
Human Settlements	Key points	Trend	
Housing	<ul style="list-style-type: none"> • Informal dwellings constitute 18.2% of households in 2011 (up from 16.7% in 2001) • Housing shortage of 400 000 units 	<i>Backlog increasing</i>	
Access to basic services	<ul style="list-style-type: none"> • 99.1% piped water (up 0.8% from 2001) • 93.4% electricity (up 5.3% from 2001) • 90.5% sanitation services (up 2.2% from 2001) • 91.1% refuse removal (up 2.3% from 2001) 	<i>Improving</i>	
Access to transportation	<ul style="list-style-type: none"> • Well developed, but historic patterns dominate • New forms of public transport taking off 	<i>Improving</i>	
Open space provision	<ul style="list-style-type: none"> • Insufficient and often inappropriate 	<i>Insufficient data</i>	
Air Quality	Quantification	Trend	
Atmospheric pollutants	<ul style="list-style-type: none"> • Particulate matter (PM₁₀) – below threshold but shows steady increase • Nitrogen oxides (NO, NO_x) – acceptable but problems at certain locations • Sulphur dioxide (SO₂) – below threshold • Green House Gases (GHG) – levels increasing 	<i>Insufficient data</i>	

District breakdown	<ul style="list-style-type: none"> City of Cape Town – higher concentrations of all parameters <ul style="list-style-type: none"> General problem in the form of smog ('brown haze') – linked to vehicle emissions Cape Flats – high PM₁₀ and volatile organic compounds (VOC) – due to domestic fuel burning, traffic and industry Cape Winelands – high particulate matter (PM) and NO₂, linked to fugitive agricultural spraying Central Karoo – transportation related emissions Eden emissions – concentrations at PetroSA, Oudtshoorn (tanneries and abattoirs) Overberg – has highest per capita vehicle ownership, indicating potential issues over time West Coast – concentrated emissions from industries using coal, red oxide dust from iron ore handling at the Saldanha port, mines (e.g. dust from lime production, Matzikama), and aqua/mariculture industries (e.g. St. Helena Bay fishmeal production) 	<i>No change</i>	
--------------------	--	------------------	---

Climate Change	Key points	Trend	
Projected change	<ul style="list-style-type: none"> 1°C warming by late 2030s, warmer minimum and maximum Highly uncertain, but possibly drying towards the west, and shorter rainy season, stronger winds, and approximate 5cm sea level rise over 25 years 	<i>Declining</i>	
Carbon footprint	<ul style="list-style-type: none"> Total emissions (contribution to greenhouse effect measured in carbon dioxide equivalent (CO_{2e}) emissions): <ul style="list-style-type: none"> 41,303,482 tonnes CO_{2e} (2009) (compared to -17,000,000 tonnes CO_{2e} in 2001) 53% of provincial total due to electricity consumption Carbon intensity: <ul style="list-style-type: none"> Emissions relative to population size - 8 tonnes per capita in 2009 compared to 5.8 tonnes per capita in 2001 178 tonnes per million Rand contribution of Gross Domestic Product (GDP) (2009) GHG contributions: <ul style="list-style-type: none"> 36% from industry, 28% from transport City of Cape Town 57% of total, West Coast District 22% 	<i>Limited historical data</i>	

Energy	Key points	Trend	
Energy generation	<ul style="list-style-type: none"> Oribi/Oryx oil field (2% of RSA liquid fuels) PetroSA coal/gas-to-liquid plant 2x open cycle gas turbines (2 084MW) 2x gas turbines (207 MW) Koeberg nuclear reactor (1 800MW) Palmiet pumped storage (580MW) 4x solar, 4x wind farms planned under the Independent Power Producers (IPP) process Eskom Sere wind farm under construction 	<i>Improving</i>	
Energy use	<ul style="list-style-type: none"> Total excluding marine and aviation: <ul style="list-style-type: none"> 247 742 000 GJ in 2004 270 887 000 GJ in 2009 52% used by transport (previously 35%) Mostly coal based electricity and liquid fuels CoCT consumes 60%, West Coast 24% 	<i>Declining</i>	
Energy intensity	<ul style="list-style-type: none"> 64 GJ/capita 8t CO_{2e}/capita Even higher intensity per unit of GDP West Coast 6x higher intensity than provincial average (industries) Central Karoo relatively high due to overland transport 	<i>Concern</i>	
Domestic energy use	<ul style="list-style-type: none"> Households electrified: <ul style="list-style-type: none"> 83.5% in 2005 93.4% in 2011 Decreasing % of households using electricity for heating Energy other than electricity: <ul style="list-style-type: none"> 7% for lighting 13% for cooking 21% for heating 	<i>Improving</i>	

Waste Management	Key points	Trend	
Waste generation	<ul style="list-style-type: none"> • Total: <ul style="list-style-type: none"> ◦ 1,446,500 tonnes per annum in 2001 ◦ 3,807,765 tonnes per annum in 2010 • 70% generated in CoCT, but relative contribution falling • Mostly paper, plastic, organic waste and builder's rubble 	<i>Declining</i>	
Waste collection	<ul style="list-style-type: none"> • 94% of households have refuse removal services (82% in 2001) 	<i>Improving</i>	
Waste management	<ul style="list-style-type: none"> • 193 operational waste management facilities: <ul style="list-style-type: none"> ◦ 92 general waste disposal ◦ 54 drop-offs ◦ 15 transfer stations ◦ 13 materials recovery facilities ◦ 6 planned/existing regional waste disposal sites 	<i>Improving</i>	

ANNEX 4: ACRONYMS

ACIP	Accelerated Community Infrastructure Programmes	EVD	Ebola Virus Disease
AFOLU	Agriculture, Forestry and Other Land Use	EWS	Early Warning Systems
APM	All Possible Measures	FEPA	Freshwater Ecosystem Priority Areas
BGCMA	Breede-Gouritz Catchment Management Agency	FTE	Full Time Equivalent
BRIP	Berg River Improvement Plan	GDP	Gross Domestic Product
C.A.P.E.	Cape Action for People and the Environment	GEF	Global Environment Facility
CAPA	Climate Change Adaptation Plan of Action	GGHHN	Global Green and Healthy Hospitals Network
CARA	Conservation of Agricultural Resources Act	GHG	Greenhouse Gas
CBG	Compressed Biogas	GIPTN	George Integrated Public Transport Network
CCGT	Combined Cycle Gas Turbine	GIS	Geographic Information Systems
CCR	Climate Change Response	GJ	Gigajoules
CCRPD	Climate Change Response Projects Database	GWh	Gigawatt hour
CCT	City of Cape Town	HEI	Higher education institutions
CH₄	Methane	HP	High pressure
CHEC	Cape Higher Education Consortium	HVAC	Heating, Ventilation, Air Conditioning
CMA	Catchment Management Area	IAP	Invasive Alien Plants
CNG	Compressed Natural Gas	ICE	Internal Combustion Engine
CO₂	Carbon dioxide	IDP	Integrated Development Plan
COP	Conference of Parties	IEE	Industrial Energy Efficiency
CPUT	Cape Peninsula University of Technology	IFC	International Finance Corporation
CSP	Concentrated Solar Power	INDC	Intended Nationally Determined Contribution
DAFF	Department of Agriculture, Forestry and Fisheries	IPPU	Industrial processes and product use
DBSA	Development Bank of South Africa	IPNTN	Integrated Public Transport Network
DEA	Department of Environmental Affairs	ISSP	Informal Settlement Support Plan
DERO	Desired Emission Reduction Outcomes	kWh	Kilowatt hour
DMA	Disaster Management Act	LTAS	Long Term Adaptation Scenarios
DMAA	Disaster Management Amendment Act	M&E	Monitoring and Evaluation
DOE	Department of Energy	MDB	Multilateral Development Banks
DORA	Division of Revenue Act	MEC	Member of Executive Council
DoCG	Department of Cooperative Government	MIG	Municipal Infrastructure Grant
DRR - M	Disaster Risk Reduction Management	MPA	Marine Protected Areas
DWAF	Department of Water and Forestry	MW	Megawatt
DWS	Department of Water and Sanitation	NBA	National Biodiversity Assessment
EE	Energy Efficiency	NBI	National Business Initiative
EEDSM	Energy Efficiency Demand Side Management	NCCRWP	National Climate Change Response White Paper
EGS	Ecosystem Goods and Services	NCMP	National Coastal Management Programme
EIA	Environmental Impact Assessment	NCPC-SA	National Cleaner Production Centre – South Africa
EMP	Estuary Management Plan	NDMC	National Disaster Management Centre
EMU	Electric Multiple Unit	NDMF	National Disaster Management Framework
EnMS	Energy Management Systems	NERSA	National Energy Regulator South Africa
ESO	Energy systems optimisation	NFEPA	National Freshwater Ecosystem Priority Areas
		NGO	Non-Governmental Organisation

NMT	Non-motorised transport	SSEG	Small-scale embedded generation
NRL	Non-revenue losses	SWH	Solar water heaters
PAES	Protected Area Expansion Strategy	SWSA	Strategic Water Source Areas
PBSAP	Provincial Biodiversity Strategy and Action Plan	SU	Stellenbosch University
PM10	Particulate matter	tCO_{2e}	Tonnes Carbon Dioxide equivalent
PPTIF	Provincial Public Transport Institutional Framework	TMF	Table Mountain Fund
PSDF	Provincial Spatial Development Framework	WC	Western Cape
PSEE	Public Sector Energy Efficiency Programme	WCC-CARF	Western Cape Climate Change Agriculture Response Framework
PSG4	Provincial Strategic Goal 4	WCCCRS	Western Cape Climate Change Response Strategy
PSP	Provincial Strategic Plan	WCDM	Western Cape Disaster Management
PV	photovoltaic	WCG	Western Cape Government
R&V	Risk and Vulnerability	WCG: EADP	Western Cape Government : Environmental Affairs and Development Planning
RBIG	Regional Bulk Infrastructure Grant	WCG: HS	Western Cape Government : Human Settlements
RE	Renewable energy	WCHSF	Western Cape Human Settlements Framework
REDZ	Renewable Energy Development Zones	WC-SWMP	Western Cape Sustainable Water Management Plan
REEEP	Renewable Energy and Energy Efficiency Partnership	WC/WDM	Water Conservation / Water Demand Management
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme	WCWSS	Western Cape Water Supply System
RMMP	River Maintenance and Management Plan	WMA	Water Management Areas
SEA	Strategic Environmental Assessment	WRP	Water Resources Planning
SALGA	South African Local Government Association	UCT	University of Cape Town
SANBI	South African National Biodiversity Institute	UNFCCC	United Nations Framework Convention on Climate Change
SANS	South African National Standards	UNIDO	United Nations Industrial Development Organisation
SAQA	South African Qualifications Authority	UNISDR	United Nations International Strategy for Disaster Reduction
SDF	Spatial Development Framework	US\$	United States Dollar
SDG	Sustainable Development Goal	UWC	University of Western Cape
SIPs	Strategic Infrastructure Programmes	VOC	Volatile Organic Compounds
SME	Small Medium Enterprises	VSD	Variable Speed Drives
SO₂	Sulphur dioxide		
SOEOR	State of Environment Outlook Report		
SPLUMA	Spatial Planning and Land Use Management Act		

PHOTOGRAPH CREDITS

- Cover** Photo: Shutterstock / Karoo / Copyright: Francois Loubser
- P6** Photo: Western Cape Government Department of Agriculture, Francina Swart
- P8** Photo: Western Cape Government Department of Agriculture
- P10** Photo: Rodger Bosch, MediaClubSouthAfrica.com
- P11** Photo: Shutterstock / Renewable Energy / Copyright: AngelC
- P12** Photo: Warrenski <https://creativecommons.org/licenses/by/2.0/>
- P13** Photo: Western Cape Government Department of Agriculture
- P15** Photo: @GreenCape. Images reproduced with permission from GreenCape
- P16** Photo: Shutterstock / dehydrated dry small plant on dry soil / Copyright: GoBOb
- P17** Photo: Shutterstock / A photo voltaic solar power installation in a rural area of South Africa, utilizing the abundance of sunlight energy in summer/ Copyright: Danie Nel
- P18** Photo: Shutterstock / coal power station with emissions. / Copyright: Christian Mueller
- P26** Photo: Shutterstock / Nuclear power plant on the coast. Ecology disaster concept. / Copyright: Kletr
- P31** Photo: Hottentots-Holland Mountains nature reserve, near Somerset West/Cape Town, Western Cape, South Africa / Copyright: PhotoSky
- P37** Photo: Western Cape Government Department of Agriculture
- P42** Photo: Shutterstock / A photo voltaic solar power installation in a rural area of South Africa, utilizing the abundance of sunlight energy in summer/ Copyright: Danie Nel
- P52** Photo: Muizenberg, Western Cape, South Africa - CIRCA 2014 - Refuse collection workers with a garbage truck at Muizenberg a coastal resort near Cape Town South Africa / Copyright: Peter Titmuss
- P57** Photo: Western Cape Government Department of the Premier
- P64** Photo: Imizamu Yethu Township Houtbay near Cape Town / Copyright: Diriye Amey
- P68** Photo: Kirstenbosch botanical garden, Cape Town / Copyright: Karel Gallas
- P75** Photo: Shutterstock / Wave breaking against the harbor wall, Kalk Bay, Western Cape, South Africa / Copyright: Sean Nel
- P82** Photo: Western Cape Government Department of the Premier
- P87** Photo: : @GreenCape. Images reproduced with permission from GreenCape
- P89** Photo: Shutterstock / Forest fire in night. Shot near Stellenbosch, Western Cape, South Africa. / Copyright: PhotoSky
- P90** Photo: Western Cape Government Department of Agriculture, Piet Lombard
- P92** Photo: Swartberg Mountains, Caledon, Western Cape, South Africa / Copyright: PhotoSky
- P96** Photo: Shutterstock / coal power station with emissions. / Copyright: Christian Mueller

PRODUCED BY:

Directorate: Climate Change

Western Cape Department of Environmental Affairs and Development Planning

Leeusig Building, 01 Dorp Street, Cape Town, 8001

Private Bag X9086, Cape Town, 8000

Tel: +27 21 483 2753

E-mail: Sarah.Birch@westerncape.gov.za

www.westerncape.gov.za/eadp



**Western Cape
Government**

Environmental Affairs and
Development Planning

ISBN: 978-0-621-44930-2
FIRST PRINT/ EERSTE DRUK:
PR321/2016