



EMALAHLENI
LOCAL MUNICIPALITY

2021

Emalahleni Local Municipality

Climate Change Strategy



Prepared by:
Sustainable Energy Africa
for Emalahleni Local Municipality,

with support from the project:

Vertical Integration and Learning for Low Emission
Development
(V-LED+): Strengthening National and Sub-National
Capacities to Promote Local Climate Protection and
Low-Carbon Development in Africa



Supported by:



Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

based on a decision of the Parliament
of the Federal Republic of Germany

Table of Contents

i.	List of Figures	6
ii.	List of Acronyms.....	7
iii.	Executive Summary.....	9
1.	Introduction and Background	14
1.1.	Defining Climate Change	16
1.2.	Mitigation and Adaptation	18
2.	Broad climate change overview and policy context	21
2.1.	Global Overview	21
2.2.	National overview	22
2.2.1.	National Policy Frameworks Supporting Climate Change Response Planning.....	25
2.3.	Provincial overview	29
2.3.1.	Provincial Legislation for Climate Change Response Planning	30
2.4.	District Municipal overview	31
3.	Emalahleni LM Situational Analysis	34
3.1.	Settlement growth analysis.....	34
3.2.	Population growth analysis	35
3.3.	Household access to services.....	35
3.4.	Economic overview	36
3.5.	Temperature and rainfall projections	36
3.5.1.	Temperature Projections	37
3.5.2.	Rainfall projections	38
4.	Emissions and Energy for Development	40
4.1.	Summary of Particulate emissions.....	40
4.2.	Mining Emission Inventory Results	40
4.3.	Greenhouse gas emissions.....	41
4.3.1.	Emissions by fuel.....	41
4.3.2.	Emissions by Sector.....	41
4.4.	Energy consumption picture for development.....	42
5.	Framing the Risk, Vulnerability and Hazards Profile.....	44
5.1.	Environmental Vulnerability	44
5.2.	Socio-economic vulnerability	45
5.3.	Economic Vulnerability	45
5.4.	Physical Vulnerability	46
5.5.	Sector-Based Vulnerabilities, Hazards and Prevailing Impacts.....	47

5.5.1. Infrastructure Services.....	47
5.5.2. Environmental Management Services.....	48
5.5.3. Community Safety.....	49
5.5.4. Spatial Planning and Human settlements.....	51
5.5.5. Local Economic Development.....	51
5.6. Institutional Vulnerabilities Hindering Climate Response	52
6. Emalahleni’s Climate Change Strategy	56
6.1. Problem Statement	56
6.2. Local government mandate relevant to climate change	57
6.3. Purpose of developing a Climate Change strategy	58
6.4. Climate Change Strategy Vision, Mission and Objectives.....	60
6.4.1. Vision.....	60
6.4.2. Mission.....	60
6.4.3. Objectives.....	60
6.5. Climate change integration into the IDP.....	61
7. Emalahleni Climate Response Approach	64
7.1. Climate Response overview	64
7.2. Adaptation and Mitigation responses.....	65
7.2.1. Potential Adaptation Responses for Emalahleni	65
7.2.2. Potential Mitigation Responses for Emalahleni.....	66
7.3. Climate Action Response and the Just Transition.....	66
7.4. Just Transition in the Emalahleni Local Municipality context.....	70
7.5. Climate Change Cross-cutting Responses	71
7.6. Strategic Response Action Plan.....	74
7.6.1. Strategic Focus Area: Governance.....	74
7.6.2. Strategic Focus Area: Environment	77
7.6.3. Strategic Focus Area: Infrastructure	80
7.6.4. Strategic Focus Area: Economy.....	83
7.6.5. Strategic Focus Area: Social	86
7.6.6. Strategic Focus Area: Spatial planning and cross-cutting issues	87
8. Emalahleni LM’s commitment and political will to climate change response	89
8.1. Climate change related challenges	90
8.2. Commitments to addressing climate change.....	90
8.3. Financial mechanisms for climate change response.....	91
9. Climate Change Response – helpful resources and support documents.....	95
9.1. Climate change response updates	95

9.2.	Climate change adaptation action for municipalities	95
9.3.	Greenhouse Gas (GHG) emissions inventory development resources.....	96
9.4.	Climate finance.....	97
9.5.	Net zero carbon buildings	97
9.6.	Green Economy and Just Transition.....	98
9.7.	Energy.....	100
9.7.1.	Energy Efficiency	100
9.7.2.	Renewable Energy	101
9.7.3.	Energy Poverty	103
9.8.	Gender Considerations.....	104
9.9.	Data	104
10.	References	107

i. List of Figures

Figure 1: Greenhouse gas sources.....	17
Figure 2: National GHG emissions contributions by sector in 2015	23
Figure 3: Settlement Growth Pressure points	34
Figure 4: Emalahleni Growth Pressure Analysis.....	35
Figure 5: Emalahleni Average Temperature.....	37
Figure 6: Emalahleni Average Rainfall	38
Figure 7: Emalahleni Environmental Vulnerability Analysis	44
Figure 8: Emalahleni Socio-Economic Vulnerability Analysis.....	45
Figure 9: Emalahleni Physical Vulnerability Analysis.....	46
Figure 10: Process to Integrate Climate Change into the Municipal IDP.....	62
Figure 11: The Different Mechanisms available to Municipalities to Fund Climate Action	92

ii. List of Acronyms

COGTA	National Department of Cooperative Governance and Traditional Affairs
COP	Conference of the Parties
CSIR	Council of Scientific and Industrial Research
DFFE	Department of Forestry, Fisheries and the Environment
DARDLEA	Department of Agriculture Rural Development Land and Environmental Affairs – Mpumalanga Province
DPWRT	National Department of Public Works, Roads and Transport
EE	Energy Efficiency
ELM	Emalahleni Local Municipality
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GVA	Gross Value Added
GIZ	The Deutsche Gesellschaft für Internationale Zusammenarbeit (GmbH)
IDP	Integrated Development Planning
ILO	International Labour Organization
IWMP	Integrated Waste Management Plan
IPP	Independent Power Producer
IRP	Integrated Resource Plan
IPCC	Intergovernmental Panel on Climate Change
KPI	Key Performance Indicator
LED	Local Economic Development
MCCMS	Mpumalanga Climate Change Mitigation Strategy
MWp	Megawatt peak – a measure of the maximum potential output of power (1000kW= 1MW)
NDC	Nationally Determined Contribution
NDM	Nkangala District Municipality
NEMA	National Environmental Management Act
NEVA	National Employment Vulnerability Assessment
NPC	National Planning Commission
NOx	nitrous oxide (greenhouse gas)
NDM	Nkangala District Municipality
P4C	Presidential Climate Change Coordinating Commission
PM ₁₀	particulate matter with an aerodynamic diameter of less than 10 µm
PM _{2.5}	particulate matter with an aerodynamic diameter of less than 2.5 µm
PPP	Public Private Partnership
PSDF	Provincial Spatial Development Framework
RE	Renewable Energy
REDZ	Renewable Energy Development Zones
SACN	South African Cities Network
SEA	Sustainable Energy Africa
SMME	Small Medium and Micro Enterprise

SO ₂	Sulphur dioxide
RE	Renewable Energy
REDZ	Renewable Energy Development Zones
SACN	South African Cities Network
SEA	Sustainable Energy Africa
SDBIP	Service Delivery Budget Implementation Plan
SJRP	Sector Jobs Resilience Plan
SONA	State of the Nation Address
SSEG	Small-Scale Embedded Generation
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization

iii. Executive Summary

Climate change is a global issue that requires a multi-level governance response for its effects to be circumvented. Emalahleni Local Municipality (ELM) finds itself at the center of climate response in South Africa and the Mpumalanga Province because of its geographical positioning. eMalahleni is home to a large concentration of the country's coal power stations and a significant number of the country's coal mines. Mining-related activities have directly and indirectly contributed to increasing air and water pollution as well as greenhouse gas emissions. Adding to this, the economic and socio-economic circumstances remain highly vulnerable to recurring climate-related disasters in many communities within Emalahleni LM. Emalahleni LM has natural resources of significant value in terms of ecological richness and biodiversity – both of which are threatened by climate change.

The Emalahleni climate change response strategy seeks to build mechanisms within the municipality that will be integrated into the existing strategic plans and operations of the municipality and further strategically position the municipality to proactively respond to climate change. In responding to climate change, the Emalahleni Local Municipality seeks to:

- i. identify and implement appropriate response strategies towards reducing particulate matter pollution and greenhouse gas emissions
- ii. develop mitigation and adaptation strategies to yield significant short and long-term, environmental, social, and economic benefits, including the promotion of the green economy.
- iii. position of the municipality to participate and respond to the Just transition
- iv. develop action responses that will be integrated into municipal budgeting processes for implementation.

The Constitution of South Africa (1996), the Local Government White Paper (2006); the Municipal Systems Act (2000) and the Municipal Structures Act (1998) assign municipalities a host of responsibilities that broadly relate to the provision of services at a local level. In this context, municipalities are tasked with creating an environment that facilitates economic opportunities, the provision of free basic services to the poor and investment in infrastructure. The municipality is developing a climate change strategy to integrate climate response into the municipal Integrated Development Plan. This will enable short to medium term actions to be taken and possibly budgeted for. The strategy will be the gateway towards deliberate climate response inclusion in the various sector plans that the municipality is required to have.

Vision

To be a people-centered and innovative local municipality that is responsive to the impact of climate change, through building climate resilience, resource efficiency and carbon neutrality.

Mission

Building climate-resilient communities through sustainable delivery of services that promotes smart and inclusive economic and social development and environmental sustainability.

Strategic objectives of the Climate Change Strategy

The climate change strategic objectives have been developed to closely align with the strategic objectives that the municipality is founded on and operates under, as articulated in the municipal Integrated Development Plan. Such alignment at the very outset is essential to enable the process of mainstreaming climate-responsive action into the overarching vision and developmental objectives of the municipality. To this end, the climate change strategy objectives are broadly categorized according to the key strategic development areas embraced by the municipality, and therefore directly positioned to respond to climate change in the municipality.

The methodology followed to develop the strategy

Status Quo Assessment

The development of this document started with an analysis of the current status quo in terms of the geographical, physical, environmental (climate change-related) and economic analysis of the locality. This was also done through close stakeholder consultation with senior officials from the Environmental Management Unit in Emalahleni LM, and DARDLEA. A high-level discussion document was presented at the municipal Climate Change Strategy Development Inception meeting, to gather additional information and to garner support for the development of the strategy from all directorates in the municipality. Further information was sought from existing sector plans, and strategies as well as additional climate change response literature from global and national sources.

Stakeholder Engagement

A series of municipal stakeholder workshops were held with municipal officials and Mpumalanga Province (DARDLEA) to build on existing institutional knowledge and experience around responding to current and past climate events and development challenges. Multiple perspectives are important for developing a robust response to climate change. The first workshop involved building together the vision, mission and strategic objectives of the climate change strategy.

Subsequent sector-based consultative workshops were held with various units in the municipality, in order to provide the basis for the development of a climate change strategy. Sectoral roles and responsibilities, challenges impeding climate response and project-related work concerning climate response were engaged with at these sector climate change response planning workshops.

Data collection and Analysis

A brief high-level energy and carbon emissions profile was compiled for the municipality to understand the key energy and emissions issues facing the municipality. Due to limitations in access and availability in data, a complete energy and carbon emissions profile was not developed and remains as future work to be done by the municipality.

Developing the climate change strategy

Information drawn from the situational analysis, stakeholder consultation workshops and all available data gathered (both numerical and literature-based) enabled an understanding of current climate and environment and related challenges facing the municipality and the context in which climate change required to be considered. This vital information informed the crafting of the Emalahleni Climate Change Strategy.

Section 1: Introduction and Background

This section provides an overview of climate change, introduces the role of local government in climate change response and defines the key approaches in responding to climate change.

Section 2: Broad climate change overview and policy context

This section provides an overview of the policy and legislative frameworks supporting climate response ranging from global, national, provincial to local. These are then aligned to Emalahleni LM current and future climate responses.

Section 3: Emalahleni Situational Analysis

The section highlighting the key social, economic and weather characteristics of the municipality, provides the context in which a changing climate can be considered.

Section 4: Emissions and Energy for Development

The chapter discusses the high level energy and emissions profile of the municipality, providing insight into the climate related issues facing the municipality.

Section 5: Risk, Vulnerability and Hazards Profile

This section provides a high-level risk and vulnerability profile for the municipality which is necessary to craft climate response actions (mitigation and adaptation) for the municipality.

Section 6: Framing the Emalahleni Climate Change Strategy

This section delves into the actual strategy, infusing the vision, mission, and objectives with a high-level climate response strategy. The strategy has been developed to align with and complement the priorities of the National Climate Change Response Policy (2011) and other important policy frameworks governing the functioning of local government. The focus is to support climate-resilient development, through both

mitigation and adaptation responses, with an emphasis on generating responses that are true to Emalahleni context.

Section 7: Strategic Climate Response Approach

The section provides the high level strategic plan for the municipality to respond to climate change in line with the objectives of this strategy. The section also discusses the Just Transition context facing the municipality which the plan aims to respond to

Section 8: Municipal Commitment and Political will to Climate Change

The section highlights the commitments made by the administration of the municipality towards incorporating climate response to date. The section includes mainstreaming of climate change within existing governance structures, institutional systems, and financial mechanisms, to advance climate change response action planning in Emalahleni.

Section 9: Climate Change Response – Helpful resources and support documents

The section provides links to valuable resources and documents for the Municipality to draw on, to inform and guide their climate response planning and implementation.



1. INTRODUCTION AND BACKGROUND

1.1. Defining Climate Change

1.2. Mitigation and Adaptation

1. Introduction and Background

*“We have to **act now** if we are to achieve sustainable and inclusive growth, secure the health and well-being of our people and safeguard the future of our planet.” (President of the Republic of South Africa – Mr Cyril Ramaphosa, 2021)*

Climate change is a global threat which has already caused significant economic, social, and environmental impacts. A large body of scientific research over the last 5 decades has revealed that much of the increasing carbon emissions and global warming experienced in the last century, is predominantly attributed to human-induced activity. Much of these activities are the burning of fossil fuels for energy production, forest clearing, and unsustainable agricultural practices among others. Human behavioural change is critically important for climate response.

The global Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment report (2014), as well as the IPCC Special Report on Global Warming of 1.5 degrees (2018) state that warming of the climate system is now undeniable. Over the past several decades, unprecedented changes to global climate systems have been observed. According to the IPCC, “Human activities are estimated to have caused approximately 1.0 °C of global warming above pre-industrial levels, with a likely range of 0.8 °C to 1.2 °C. Global warming is likely to reach 1.5 °C between 2030 and 2052 if it continues to increase at the current rate.

The latest report from the world’s leading climate scientists has warned that the pace of global warming is rapidly increasing, and Sub-Saharan Africa has been experiencing temperature increases well above the global average (IPCC, 2021). The IPCC 2021 report indicates that this decade provides technically the last attempt for the world to meet the overall year temperature increase by 1.5⁰ C, which means global emissions reductions of 50% by 2030. Considering that an emphasis around the human activity is the leading contributor to global temperature increases, meeting these targets are no longer scientific objectives but those that require political will.

Climate change presents serious health, environmental and economic risks for South Africa. These risks will have increasingly damaging effects on human health, water availability, food production, infrastructure and migration. South Africans are already experiencing the impacts of climate change through drought and flooding, which have an effect on livelihoods. Several communities in the Mpumalanga, for example, are affected by high levels of pollution, which increases respiratory illness and other diseases. Those who are dependent on the ocean for a living have already seen depleted fish stocks amid changing weather patterns and changes in ocean temperature.

South Africa has warmed considerably over the past 80 years, with parts of the country having warmed at twice the global rate. Increased warming of more than 4 – 6 °C is forecasted for South Africa over the next few decades, rendering climate change the defining context for South Africa's development, with economic, social, and ecological consequences. Climate change poses a substantial risk to South Africa's development gains, exacerbating the existing national challenge of widespread poverty, unemployment, and inequality and undermining the country's efforts to achieve the United Nations Sustainable Development Goals (SDGs) and Africa's Agenda 2063. However, these challenges also present opportunities for both climate adaptation, mitigation, and the green economy. An impactful climate change response is complex and transcends multiple socio-economic and environmental sectors and spheres of government. It demands coherence, coordination, alignment and sequencing of policies, response measures and concerted implementation of actions by various role-players, all of which constitutes South Africa's climate change response.

South Africa's vision for an effective response to climate change is set out in the National Climate Change Response Policy (NCCRP, 2011) and reinforced by the National Development Plan (NDP): Vision 2030 of a transition to an environmentally sustainable, climate change resilient, low-carbon economy and a just society. These policies envision an effective climate change response and long-term, just transition to a climate-resilient and low-carbon economy and society. Further, as a signatory to the global Paris Agreement (where governments agreed to limit global temperature rise to well below 2°C and to make efforts to limit this to 1.5°C) which gives national governments the opportunity to set their own mitigation and adaptation targets through Nationally Determined Contributions (NDCs), South Africa has signalled its increased ambition. Cabinet recently approved our updated Nationally Determined Contribution (NDC), which sets out our emissions targets towards net-zero carbon emissions by 2050. This sets a target range for emissions, from restricting global warming to less than 2 degrees Celsius at the top of the range, with the bottom of the range compatible with the goal of restricting warming to less than 1.5 degrees Celsius. The NDCs seeks to place climate response at the centre of a national economic recovery path that has not only been set back by the Covid-19 pandemic but has also been in recession. Noting the human impact on climate change, climate action response needs to be largely focused on behavioural change efforts as means to building a new, inclusive economy that creates employment and fosters sustainable growth (DEA 2021).

In this context local climate actions are crucial for South Africa to meet its Nationally Determined Contribution (NDC) under the Paris Agreement, while simultaneously delivering on the promise of poverty alleviation, equality, and employment. The country's 18 largest cities are engines of economic growth, accounting for approximately 80 per cent of the country's wealth and roughly half of its electricity and petrol consumption (Wolpe and Reddy 2015). Over the past two decades, research has highlighted the critical role of local governments in reducing greenhouse gas

emissions. Many of the sectors with high mitigation potential, such as housing, transport, land use, urban planning, infrastructural development, and waste, are often under the control of sub-national government entities. Leveraging this “transformative power”, an increasing groundswell of sub-national actors has set ambitious GHG reduction goals and moved ahead even in the absence of national leadership or significant international progress (UN Habitat 2016; WBGU–German Advisory Council on Global Change 2016).

Climate response is a multi-level government responsibility including non-state actors. Whilst the national government sets the tone for climate response in the country, local government has the expansive task of translating those commitments to actions that can be implemented. At the local level, the key step that sets the tone for climate response is necessitated by mapping out greenhouse gas emissions by sector, followed by integrated climate action planning and producing the required climate response actions. The success of this process requires the active participation of all municipal directorates, political will, and community participation. This process is also outlined in the National Climate Change Response Policy, the blueprint for South Africa’s response to climate change. The policy recognizes local government as an important agent of delivery. Its twin objectives are a) to contribute to the global efforts to bring GHG emissions to levels ‘required by science’ to curb catastrophic climate change, and b) to manage the unavoidable impacts of climate change. Section 10.2.6 notes the key role of provincial and local government in meeting the challenge of climate change. For local government, it particularly identifies the areas of 1) planning and urban development, 2) municipal infrastructure and services, 3) water, energy, and waste demand management and 4) local disaster response.

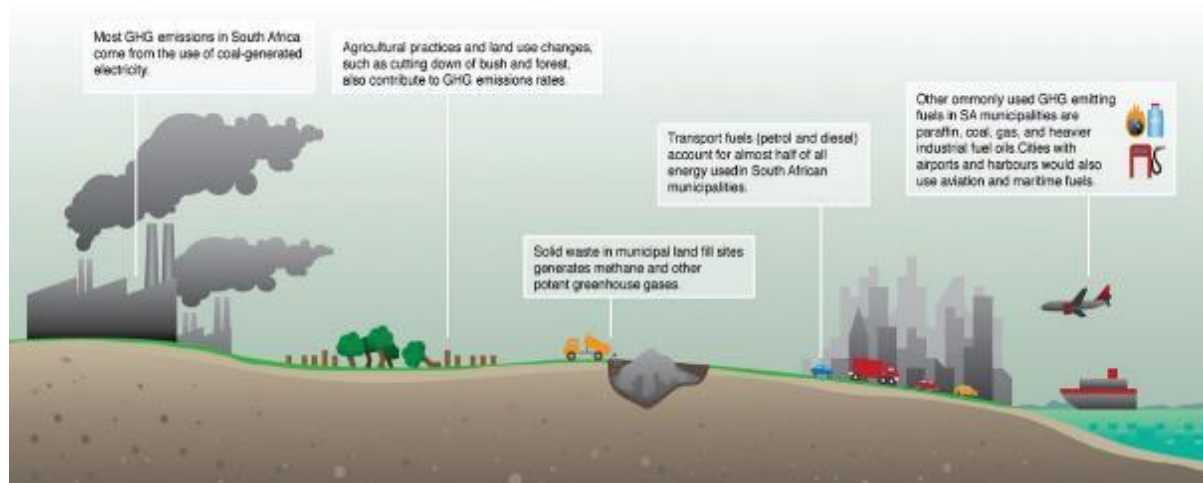
Local governments are crucial to addressing climate change. As frontline responders to the effects of global warming, they create sustainable development pathways and opportunities for resilient communities. The climate actions of local government and provinces are essential to pioneering transformative decarbonization processes and achieving the objectives of the Paris Agreement, but it requires the collaboration and coordination across governing levels to ratchet up efforts and bring successful initiatives to scale.

1.1. Defining Climate Change

*“Climate change is defined as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods.”
Article 1 of the United Nations Framework Convention on Climate Change (UNFCCC 2011)*

Climate change is due to changes in the general weather conditions attributed to an increase in the temperature of the earth's surface. It refers to prolonged shifts in weather patterns spanning time scales of 20 to 50 years and above. Besides an increase in average temperature, climate change may also involve a change in weather patterns (e.g., rainfall) or in the frequency and/or intensity of weather events (e.g., more, or fewer storms).

Figure 1: Greenhouse gas sources



Source: (DEA 2012)

In order to understand climate change, the 'greenhouse effect' needs to be first understood and why greenhouse gases (GHGs) such as water vapour, carbon dioxide, nitrous oxide and methane are important.

The greenhouse effect is a naturally occurring phenomenon in the earth's atmosphere. As the sun's energy reaches the earth, some of this energy is reflected back into outer space and some energy is trapped in the atmosphere to warm the surface of the earth and allows for life on earth to flourish. The energy is trapped in the atmosphere partly due to the presence of GHGs. This is known as the 'greenhouse effect'.

Human activities are increasing the levels of greenhouse gases in the atmosphere (see Figure 1). The burning of coal to generate electricity, burning of petrol in cars, some chemical processes in industries, and many farming activities and changes in land use i.e. chopping down of forests and thus reducing the earth's natural ability to absorb natural gases, add to the amount of greenhouse gasses in the atmosphere. This increase in GHGs in the atmosphere is causing more energy to be trapped in the atmosphere. As more energy is trapped, the atmosphere heats up. This heating up process is referred to as 'global warming'. Warming is the simplest way for the climate to get rid of the extra energy. However, even a small rise in temperature will be accompanied by many other changes in cloud cover, wind patterns, ocean patterns etc.

As the earth's atmosphere grows increasingly warmer, it impacts on how global weather systems work. Some areas will experience significant increases in temperature and in the number of hot days and heatwaves, while other areas will have less marked increases in temperature. Similarly, some areas will experience more rainfall and flooding, while other areas will receive less rainfall which in some instances may result in drought. These large-scale changes in long-term weather patterns is what is referred to as 'climate change'.

1.2. Mitigation and Adaptation

Climate response requires that we try to reduce the cause of climate change, while also responding to the impacts that are already underway. These responses are known as mitigation and adaptation. Mitigation, together with adaptation to climate change, contribute to the objective expressed in Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC 2020): *"to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."*

Climate change mitigation efforts focus on reducing vulnerabilities, including reducing greenhouse gas emissions through initiatives related to energy efficiency and renewable energy use, in an international effort to reduce emissions to a level required by science to curb global warming. For example, switching from coal to solar as a source of energy will significantly reduce the amount of GHG emissions being released into the atmosphere. Similarly, investing in urban nature in the form of trees within municipalities can reduce the amount of GHGs in the atmosphere as trees absorb carbon dioxide. Both examples will also result in the additional benefit of cleaner, more breathable air.

Climate change adaptation efforts attempt to build resilience within our communities to the impacts and effects of climate variability and a changing climate. A resilient system can withstand change and can recover quickly. As a result, building resilience focuses on making systems, places, and people more robust, both in being able to 'bounce back after a stress, but also in being able to 'bounce forward' – adapting to long term changes in trends. In short, mitigation tries to minimise climate change, while adaptation helps people cope with the climate impacts (such as drought, crop failure, famine etc.) that are already occurring.

The projected impacts of climate change can only be reversed by mitigating and adapting to the ongoing changes, mainly with an emphasis on reducing greenhouse gas emissions. The Paris Agreement commitment to keep global warming to well below 2°C and make every effort to go below 1.5°C provides the baseline for all efforts that need to be taken to achieve this objective. These two efforts are generally realised

by doing assessments of localised risks, and integration of climate change considerations into all areas of decision-making at the local government level, up to the national government level.

2. BROAD CLIMATE CHANGE OVERVIEW AND POLICY CONTEXT

2.1. Global overview

2.2. National overview

2.3. National Legislation for Climate Change
Response Planning

2.4. Provincial overview

2.5. Relevant Provincial Legislation for Climate
Change Response Planning

2.6. District Municipal overview



2. Broad climate change overview and policy context

2.1. Global Overview

Globally, the United Nations Framework for the Convention on Climate Change (UNFCCC) provides guidance on setting protocols or agreements on reducing GHG emissions. The most recent of these is the Paris Agreement.

Climate action has been increasing since the lead-up to the Paris Conference of Parties 21 in 2015, and that, by 2016, cities and regions representing over a billion people had already committed to reducing greenhouse gases and strengthening resilience, as had businesses with revenues of USD 36.6 trillion (UNFCCC 2020). The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report of 2021 demonstrates that, in each preceding decade, the global mean temperature has been increasing since pre-industrial levels (1850–1900). Global surface temperature in the first two decades of the 21st century (2001–2020) was 0.99 [0.84– 1.10] °C higher than 1850–1900 and increased to 1.09 [0.95 to 1.20] °C in 2011– 2020, with larger increases over land. The likely range of total human-caused global surface temperature increase from 1850–1900 to 2010–2019 is 0.8°C to 1.3°C, with a best estimate of 1.07°C. It is likely that well-mixed GHGs contributed a warming of 1.0°C to 2.0°C (IPCC 2021).

With the adoption of the landmark 2015 Paris Agreement (a global agreement signed by 196 countries in 2016 to reduce their emissions to limit global temperature increases to 1.5°C above pre-industrial levels) the global climate regime shifted towards a more inclusive climate governance system, applicable to all countries to share the responsibility for a global climate response. The Paris Agreement gives national governments the opportunity to set their own mitigation and adaptation targets through Nationally Determined Contributions (NDCs). Countries will update these targets every five years from 2020 onwards, with the aim of ratcheting-up their ambition with each submission. Now, as the Paris Agreement enters into force, the focus of action is shifting from international negotiations to national, regional, and local governments that must translate the Paris goals into local climate action. Opportunities for driving climate action forward have increasingly been shaped by a diverse range of both state and non-state actors. Over the past two decades, research has highlighted the critical role of sub-national governments in reducing greenhouse gas emissions.

Governments around the world have taken action to respond to the call made in the Paris agreement of 2015. Actions that have been taken following 2015 COP 21 include the ratification of the Marrakech partnership for Global Climate Action which supports implementation of the Paris Agreement by enabling collaboration between governments and the cities, regions, businesses, and investors that must act on

climate change. The high-level champions, working with the Marrakech Partnership, have sought to move forward the objectives for 2020-2021, including: i) strengthening collaboration amongst national governments and non-Party stakeholders, ii) broadening participation, iii) creating enabling conditions for breakthroughs in ten tipping points for systems transformation, iv) following up on and ensuring continuity and coherence and v) tracking progress, impacts and results. This work has also given birth to the Race-to Zero conference in 2020 which has influenced policy for participating countries to make commitments towards Net-Zero carbon emissions by 2050 (*United Nations Climate Change 2021*).

Global climate efforts have also finally recognized and placed the spotlight on the critical role of local government and multi-level governance in climate action. There is increasing commitment from countries to implement their NDCs fully and the cooperative initiatives to meet the Paris Agreement goal of well below 2°C below pre-industrial levels. As of October 2020, subnational governments (826 cities and 103 regions) have committed to net-zero targets. It is worth noting that this increase happened despite the COVID-19 pandemic and the economic downturn that it brought about (UNFCCC 2020).

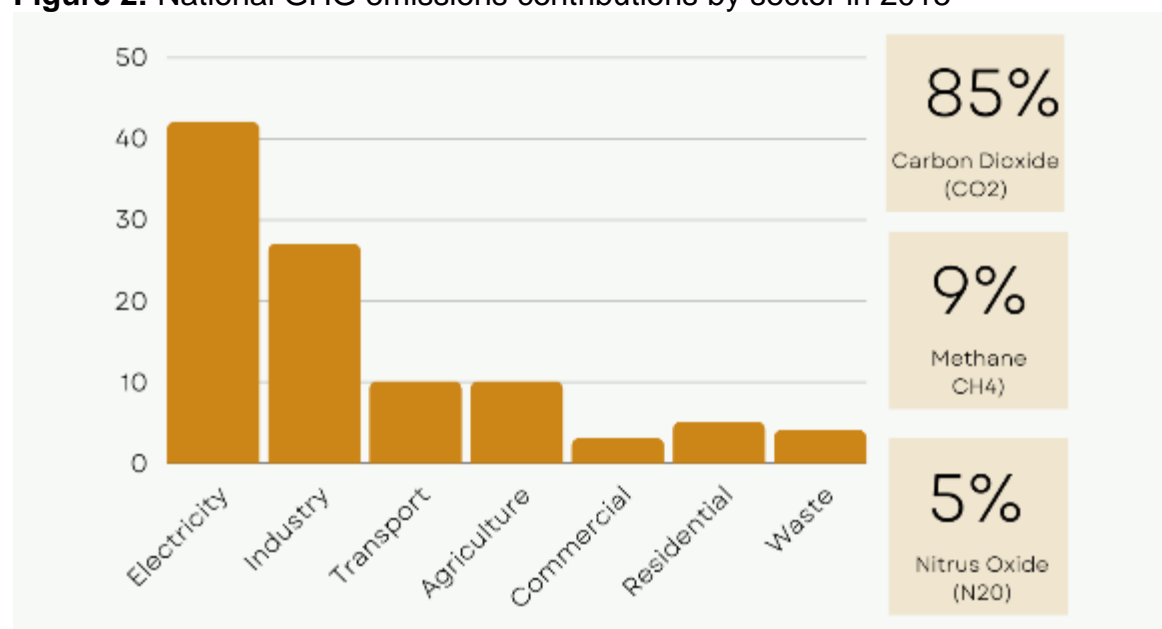
2.2. National overview

South Africa is currently the 14th largest emitter of GHG emissions globally. This means that South Africa's current development path is significantly contributing to global GHG emissions. South Africa therefore has a moral obligation to reduce emissions to ensure that the impacts of climate change are reduced both at home but also globally. Additionally, South Africa is one of the most at-risk countries in Africa to the impacts of climate change. Considering that there is an urgent need to reduce the amount of GHGs being emitted into the atmosphere (mitigation) as well as to prepare for the impacts of climate change at the local level (adaptation).

South Africa is experiencing significant effects of climate change because of increased temperatures and rainfall variability. The observed rate of warming has been 2°C per century or even higher – more than twice the global rate of temperature increases for the western parts and the northeast (DEA 2019). Evidence is showing that extreme weather events in South Africa are increasing, with heat wave conditions found to be more likely, dry spells of weather are lengthening slightly and rainfall intensity increasing. Climate zones across the country are already shifting, ecosystems and landscapes are being degraded, fires are becoming more frequent, and overused natural terrestrial and marine systems are under stress (DEFF, 2019). According to the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report (AR6), many changes in the climate system have become larger in direct relation to increasing global warming. These include increases in the frequency and intensity of hot extremes, heavy precipitation and, in some regions, agricultural and ecological droughts.

South Africa experienced severe drought between 2014 and 2017 that severely impacted the agricultural sector. Livestock was lost and there was a decline in crop production due to the drying of rivers, dams, and other freshwater resources. These changes in weather patterns, causing extreme and intense weather events, are an ongoing phenomenon in South Africa, with heavy rains experienced over the Mpumalanga, Limpopo, and Gauteng regions, which caused enormous damage to infrastructure and affected people's livelihoods. This northern region comprising these four provinces, was identified as one of the 10 climate hotspots in the world (IPCC 2014a). South Africa's aggregated gross GHG emissions excluding Forestry and Other Land Use (FOLU¹) were 439 238 GgCO₂e in 2000 and these increased by 101 616 Gigagrams CO₂e (or 23.1%) by 2015. Gross emissions in 2015 were estimated at 540 854 Gigagrams CO₂e and increased slowly over the 15 years with an average annual growth rate of 1.43%. Carbon dioxide (CO₂) accounted for the largest gross emissions contribution in this period (DEA 2015).

Figure 2: National GHG emissions contributions by sector in 2015



Source: (DFFE 2020)

For South Africa, the energy sector accounts for the lion's share of South Africa's GHG emissions (79%). This arises from coal providing an estimated 72% share of the country's total primary energy supply, a major feedstock for the country's synthetic fuel industry (e.g., Sasol's coal-to-liquid-fuel). Energy supply is therefore enormously carbon intensive. However, the adoption of the Integrated Resource Plan (IRP) in 2019 signals a shift where our energy power supply now includes the adoption of less carbon intensive sources of energy such as the bulk generation from renewable

¹ Forestry and Other Land Use (FOLU)—also referred to as LULUCF (Land Use, Land-Use Change, and Forestry)—is the subset of Agriculture, Forestry and Other Land Use (AFOLU) emissions and removals of GHGs related to direct human-induced land use, land-use change and forestry activities excluding agricultural emissions and removals

resources. Further, between 2000-2015 the carbon intensity of the economy (tonnes CO₂-eq produced per unit of GDP produced) and the energy intensity of the economy (energy used to produce a unit of GDP) decreased by 18.7% and 12.4% respectively. This is attributed to growth in the less energy intensive services and financial sectors together with a decline in manufacturing and mining (DEA 2020) and the adoption of energy efficiency practices as well as renewable energy technologies.

South African settlements are susceptible to the effects of climate variability, and since 1980 have recorded 86 noticeable weather-related disasters that have affected more than 22 million South Africans and have cost the economy in excess of R113 billion (US\$6.81 billion) in economic losses. It is anticipated that a growing number of South African cities and towns will be exposed to the impacts of weather-induced hazards such as flooding, heatwaves, droughts, wildfires, and storms. This is partly due to the projected increase in the frequency severity and intensity of weather-related hazards, but also due to the high socioeconomic vulnerability inherent within communities, as well as poor land-use practices, growing informality, and a failure to rapidly deploy resilient infrastructure associated with accommodating a growing urbanising population. It is undeniably the poor and vulnerable communities that will experience the most severe setbacks from the impacts of climate change, eroding their livelihoods, and thus threatening their resilience (DEA 2021).

South Africa has also adopted a multi-level governance approach to responding to climate change. The measurement and monitoring of climate change response is critical in ensuring the effective implementation of climate response strategies and plans. The Climate Change Response White Paper (2011) paved the way for the national government to roll out capacity building programmes across government departments and municipalities, such as the Let's Respond Toolkit which was developed by DEA in 2012. The toolkit became a key resource in supporting the mainstreaming of climate change in existing local government plans and it enabled municipalities in all provinces to start the process of integrating climate response directly into their planning headquarters – the Integrated Development Plans (IDP). Integrating climate change response into a municipal IDP is not new planning or reporting requirement. The emphasis is on identifying and prioritizing actions to meet new challenges and adjusting existing plans and projects.

In advancing existing measures implemented towards climate change mitigation and adaptation to date, President Ramaphosa in his State of the Nation Address (SONA) 2019 and 2020, further committed the country towards reducing carbon emissions, building resilience, and reducing vulnerability within communities across all sectors. He further appointed a 22-member inaugural Presidential Climate Change Coordinating Commission (P4C), with effect from 17 December 2020. The Commission is tasked with advising on South Africa's mitigation and adaptation response to climate change and its associated impacts. It will also provide independent monitoring of South Africa's progress in meeting its emissions reduction

and adaptation goals (Presidency 2020). The formation of the Commission further emphasises the countries' ambition for a just transition.

To signal South African increased climate ambition, Cabinet recently approved our updated Nationally Determined Contribution (NDC), which sets out our emissions targets towards net-zero carbon emissions by 2050. This sets a target range for emissions, from restricting global warming to less than 2 degrees Celsius at the top of the range, with the bottom of the range compatible with the goal of restricting warming to less than 1.5 degrees Celsius. The NDC takes into consideration the updated information on climate action response both globally and nationally, including the GHG emissions projections. The updated NDC focuses on the national and global shift to the green economy, green industrialisation and creating new opportunities for South Africa's rich mineral endowment, many of which are vital for low emission and climate resilient development.

The National Energy Efficiency Strategy was also updated post-2015, and will be reviewed every five years. In 2016, GHGs were formally declared priority air pollutants under the existing National Environmental Management Act. This was followed in 2017 by the gazetting of GHG reporting regulations, together with the requirement that large emitters submit annual pollution prevention plans detailing plans to reduce GHG emissions (DEA 2021).

2.2.1. National Policy Frameworks Supporting Climate Change Response Planning

It is important to align this climate change strategy with national climate change objectives to help meet national and international climate commitments. South Africa has developed, and is developing further, a variety of legislation to support local governments with effectively meeting the climate change commitments made at a national level, as well as developing effective localized responses to climate change. Below lists some of the climate change national policy developments relevant to local climate response.

i. The National Climate Change Response Policy (2011)

The National Climate Change Response Policy provides an overarching "vision for an effective climate change response and the long-term, just transition to a climate-resilient and lower-carbon economy and society", and outlines ten near-term priority flagship programmes in key sectors to achieve this vision. This policy also articulates the role and function of local government in responding to climate change

ii. Paris Agreement 2015 and National Determined Contributions 2021

As noted above, South Africa is currently the 14th largest emitter of GHG emissions globally. As a signatory to the Paris Agreement, South Africa has developed its own NDC which commits the country to transition its international mitigation commitment from a relative 'deviation from business-as-usual approach' to an absolute peak,

plateau and decline GHG emission trajectory range. This means that South Africa has committed to emissions peaking between year 2020 and 2025, stabilizing between year 2025 and 2035, and finally declining thereafter. This is South Africa's commitment to limit global temperature rise to well below 2°C and to make efforts to limit this to 1.5°C. South Africa's aspiration in the long-term is that total annual GHG emissions will be in the range of 212 to 428 MtCO₂e by 2050, having declined in absolute terms from 2036 onwards. Local governments are also required to incorporate the NDC's within their climate response plans and related development plans to operationalize these national commitments. Global and national climate change objectives can only be achieved by actions done at municipal level.

iii. National Development Plan, 2012

The NDP is South Africa's long-term development plan, intended to focus all South Africans around common objectives and priorities to drive development for current and future generations. The NDP envisages that, by 2030, South Africa will have made headway in transitioning to an environmentally sustainable, climate change resilient, low-carbon and just society (Chapter 5 of the NDP) – by promoting economic growth, social equity, and environmental sustainability. Municipal Integrated Development Plans and all other sectoral plans need to be aligned to the NDP's various chapters to cascade national planning objectives to the local level – for simplification and implementation.

iv. National Greenhouse Gas Emissions Reporting Regulations, 2017

Amended in September 2020, the National Greenhouse Gas Emissions Reporting Regulations have introduced a single national reporting system for a transparent reporting of greenhouse gas emissions, to maintain a national greenhouse gas inventory and enable South Africa to meet its UNFCCC reporting obligations. The Regulations also set out the reporting requirements, calculation methodology, verification procedure and penalties. Local government is encouraged to develop greenhouse gas inventories in line with these regulations, to track GHG emissions in their respective jurisdictions with the intention of informing the local level climate action response approach and develop relevant actions to affect the reduction of GHG emissions.

v. Climate Change Bill, 2020

The South African government has developed its Climate Change Bill which has been approved by Cabinet. Once the Bill becomes an Act it will form the legislative foundation for the climate change adaptation and mitigation response in South Africa. With respect to the mitigation response, the Bill provides for future review and determination of the national greenhouse gas emissions trajectory; determination of sectoral emissions targets for emitting sectors and subsectors; and allocation of carbon budgets. The Bill also makes provision for the development of plans to phase down or phase out the use of synthetic greenhouse gases in line with the Kigali

Amendments to the Montreal Protocol. Once the Bill is gazetted, it will provide a framework for climate response action, in particular for local government.

vi. National Climate Change Adaptation Strategy, 2019

The strategy outlines the country's climate related vulnerabilities, and the required resources to reduce those vulnerabilities, whilst demonstrating progress on climate change adaptation. It gives effect to the National Development Plan's vision of creating a low-carbon, climate-resilient economy and just society. The strategy provides a common reference point for climate change adaptation efforts in South Africa in the short to medium term, guiding all levels of government, sectors, and stakeholders affected by climate variability and change. This is a key piece of legislation for municipalities, particularly for Emalahleni that has experienced the effects of drought, to understand how to map out vulnerabilities within the municipal jurisdiction and necessary actions to build resilience.

vii. Carbon Tax, 2019

The carbon tax, officially introduced in 2019, aims to reduce carbon emissions through the implementation of a tax on carbon emissions above a determined level. This is meant to incentivize large carbon emitters to take appropriate measures which will reduce their emissions. During the first phase of its implementation (from June 2019 to December 2022), only those who own or control direct sources of emissions (known as "scope one emissions") will be taxed. There remains much uncertainty about the ultimate impact of the carbon tax on local governments.

viii. Climate Change Low-Emission Development Strategy, 2020

The strategy sets the tone for South Africa's low carbon emission transition, particularly around mitigation targets. It also includes the necessary policies and financial commitments required to meet such targets, focusing on key economic sectors that are responsible for the overall country's emissions, up to 2050. While principally focused on low-carbon development, the strategy also considers how mitigation options may affect or be affected by adaptation measures and potential combined effects of these interventions. The strategy includes measures that the government is already implementing through a comprehensive set of strategies, policies, and sector plans within the key sectors of the economy. The strategy provides an overarching reference for municipalities in their quest to also lower emissions, particularly in-terms of the sectors that should be targeted and alternative actions that are required to transition these sectors to reduce their emissions.

ix. Integrated Resource Plan, 2019

The IRP (the electricity master plan for South Africa) 2019 allocates a significant role for new renewable energy generation (solar PV and wind) by 2030, as well as a growing distributed generation allocation. This "distributed generation" category covers embedded generation between 1 and 10 MW, with an allocation of 500MW per year. Coal remains part of the energy mix in 2030, although with a reducing role. SSEG

(<1MW) is not quantitatively included but is considered in the demand forecasts used. Though the IRP provides limited details of the potential of SSEG contribution to the energy mix and cost implications for small scale generators and distributors, including potential impacts of storage within distribution networks – municipalities are well positioned, to generate their own power from renewables. Alternatively, using the IRP as guide, municipalities are able to develop their own localized IRPs, in-order to better factor in localized energy generation, and clarify within their own jurisdiction, how IPP procurement may potentially be approached, wheeling as well as feed-back tariffs for small scale energy generators connected to the municipal grid.

x. Electricity Regulation Act - Schedule 2 amendment

Schedule 2 of the Electricity Regulation Act was amended on 20 August 2021 to lift the generation facility licensing threshold from 1MW to 100MW. The main implications for municipal electricity distributors is that they can expect more applications for generation facilities above 1MW which require detailed grid impact studies, and municipalities will need to develop the capacity to evaluate these studies. Secondly, since the Amendment explicitly allows for wheeling of electricity through the grid from generators to customers, municipalities can expect an increased number of applications for wheeling arrangements, and municipalities will need to develop the billing and metering capabilities to facilitate these transactions.

xi. Post-2015 National Energy Efficiency Strategy and related National Energy Efficiency Action Plan

The role of the municipalities in addressing Energy Efficiency (EE) was brought to the fore by the Department of Energy (now the Department of Mineral Resources and Energy (DMRE)), through the National Energy Efficiency Strategy (2016), which notes that efficiency must be undertaken primarily by end users (residents, businesses), and encourages sectors and other spheres of governance to develop their own plans towards national efficiency targets. Municipalities are encouraged to have their own EE strategies that are informed by energy audits of their services and activities and aligned with provincial strategies. The municipal strategies should ensure that municipalities meet the targets set in the National Energy Efficiency Strategy

xii. SANS 204 and the National Building Regulations Part XA, 'Energy Efficiency' (2011)

This document provides for the amendment of the National Building Regulations to include energy efficiency standards in all residential and commercial buildings. Significantly, it includes water heating, where at least 50% of heating needs must be met by non-electrical resistance means. The amendment has made provision for a building envelope, fenestration, passive solar heating and insulation. This is directly applicable for implementation by municipalities.

xiii. Green Transport Strategy (2018 – 2050)

In order to address the significant contribution of transport to national GHG emissions, the Department of Transport has developed a Green Transport Strategy (GTS), which aims to reduce the adverse impact of transport on the environment; while addressing current and future transport demands. This is underpinned by sustainable development principles. The strategy aims to promote green mobility to ensure that the transport sector supports the achievement of green economic growth targets and the protection of the environment. This strategy will serve to guide transport planning in municipalities, where the transport sector is among the highest contributor of GHG emissions in municipalities.

xiv. Sector Jobs Resilience Plan (SJRP): National Employment Vulnerability Assessment (NEVA)

The NEVA explores climate-change-related impacts on businesses, workers, and communities in key-value chains, namely value chains for coal, metals, petroleum-based transport, agriculture, and tourism. The SJRP assesses the opportunities for green jobs and industries, and climate resilience interventions to anchor and drive South Africa's transition to a low carbon, climate-resilient and inclusive economy, and society. This is a key piece of legislation for municipalities, especially for Emalahleni which will be undergoing the just transition.

2.3. Provincial overview

Provincial government holds the responsibility of implementing the national policy and to support municipalities with implementation of national, provincial and local development objectives. The Mpumalanga provincial Department of Agriculture Rural Development Land and Environmental Affairs (DARDLEA) is firmly committed to building resilience and mitigating the impacts of climate change in the province and supports national climate change commitments. To date the department has developed a provincial Climate Change Risk and Vulnerable Assessment Report, followed by a Provincial Climate Change Adaptation Strategy. The strategy has two main objectives: a) to manage the impacts of climate change through building social, economic, environmental resilience and emergency response capacity and b) to contribute to the national commitment to the UNFCCC towards a low carbon future (DEA *et.al*, 2015). The province developed its Climate Change Mitigation Strategy and implementation plan, a climate change adaptation strategy, and a climate change mitigation strategy.

DARDLEA continues to capacitate and provide hands-on support to all district municipalities in the province. It supports Nkangala District municipality and its family of local municipalities to advance climate change response actions, through the development of climate response plans. This support is ongoing and is also facilitated through climate change champions appointed in each local municipality and climate change forums to facilitate knowledge exchange. The department is also establishing

the Just Transition working group which will be chaired by the Mpumalanga Premiers office, to monitor the integration of just transition into municipal projects and programmes. This work furthers the multi-level governance approach towards mainstreaming climate change to align local strategies with national priorities.

2.3.1. Provincial Legislation for Climate Change Response Planning

The provincial policy and planning legislation that has been developed to guide development in Mpumalanga will also guide the implementation of the Emalahleni Climate Change Strategy. The Emalahleni Climate Change Strategy will align with provincial legislation on climate change response planning. The following legislative frameworks are available to guide climate response by sector for the Emalahleni LM.

i. Mpumalanga Green Economy Plan, 2017

The draft plan aims to promote the shift in the province's economy from one heavily reliant on coal-based energy to one that is less carbon intensive by establishing sustainable agriculture, waste-to-energy initiatives, energy efficient buildings, adoption of renewable energy development, sustainable tourism, and eco-conscious towns by 2030. The plan aims to provide an integrated approach towards developing the green economy in Mpumalanga by 2030 in line with the Vision 2030. Specific objectives include i) developing a sector plan based on the province's strengths in natural resources endowments, ii) expanding on the economic, green and environmental initiatives that are already underway in the province in order to facilitate quick wins, iii) support the Department of Economic Development and Tourism (DEDT) drive in sustainable economic development and to iv) develop an action plan for implementation. This plan provides a solid base for the Emalahleni LM to align its economic development plan and development such that local economic sectors are provided the required support to transition from coal dependency.

ii. Mpumalanga Biodiversity Sector Plan 2014 and Mpumalanga Spatial Development Plan, 2017

The Mpumalanga Biodiversity Sector Plan includes a set of land-use guidelines that are important for maintaining and supporting the inherent biodiversity values critical for biodiversity areas. It considers climate change within a spatial analysis approach to enable species and ecosystems to adapt to climate change. The Provincial Spatial Development Framework (PSDF) considers climate change and promotes the adoption and implementation of integrated policies and plans towards the inclusion of resource efficiency, mitigation and adaptation to climate change and resilience to disasters. These plans provide a reference for spatial planning and disaster management planning at local government level, where vulnerable and disaster-prone areas need to be mapped out onto the spatial plan of the municipality. This work needs to also inform the land use management plan of the municipality, to protect the natural biodiversity, and outline areas that can be developed within the prescripts of climate response.

iii. Climate Change Adaptation Strategy, 2016

Mpumalanga Province developed a Climate Change Adaptation Strategy in 2016 supported by the national DFFE. The strategy has two main objectives: a) to manage the impacts of climate change through building social, economic, and environmental resilience and emergency response capacity and b) to contribute to the national commitment of the UNFCCC towards a low carbon future. The strategy has provided extensive guidance for municipal climate response actions, particularly prior the development of their own local climate change strategies. Thus, the local climate change strategy builds from what the provincial strategy provides.

iv. Climate Change Mitigation Strategy and Implementation Plan

The strategy provides a framework for the development and implementation of mitigation responses to climate change and is aligned with and complements the province's Climate Change Adaptation Strategy. The Plan is informed by an evidence base of, the provincial-wide GHG emissions inventory. It outlines the province's governance, powers and the partners who need to be engaged to accelerate the delivery of the province's mitigation targets.

The strategy sets forth five goals for the province related to mitigation and adaptation efforts namely 1) green the provincial energy mix: consisting of small-scale embedded generation (SSEG) renewable energy, low-carbon cooking fuel, clean transport, and sectoral renewable energy initiatives in agriculture and tourism; 2) improve energy efficiency: through projects in public sector buildings and promoting energy efficiency in the residential, commercial and industrial sectors; 3) reduce greenhouse gas emissions from resource extraction and consumption: through diversion of waste from landfills and capturing fugitive industrial emissions; 4) protect and enhance carbon sequestration potential: through carbon sequestration projects, ecosystem restoration and mitigating emissions from agriculture; 5) build capacity for transitioning to a low carbon economy: through training across different levels of government (provincial and local); KPI-linkages, and awareness-raising initiatives. The strategy hinges on collaboration between Mpumalanga DARDLEA, Department of Public Works, Roads and Transport (DPWRT), Department of Education and Training, COGTA and Treasury, among others. Donor funding support hinges on a mix of state, donor, and private funding to realise the goals.

2.4. District Municipal overview

The district municipality developed its Climate Change Strategy in 2012. This was followed by a draft Climate Change Response Plan in 2016 (DARDLEA 2016). In 2018, the municipality sought to update the strategy to have its climate change response plans and actions align with South Africa's ratification of the Paris Agreement in 2015, the Nationally Determined Contributions and the draft Climate Change Bill. This work was also guided by the Mpumalanga Province Climate Change Mitigation Strategy and Implementation Plan as well as the Provincial Climate Change

Adaptation Strategy. The reforms in the power sector resulting in the decommissioning and repurposing of the country's coal-fired power stations, which are concentrated in Nkangala District, has resulted in the urgent need for an updated climate change framework within the Nkangala district, for appropriate responses to be implemented. Climate change implementation can be accelerated at the local government (both district and local) level if a strategy is developed and integrated into the IDP so that budgets can be allocated to climate-responsive measures. Importantly, both ELM and NDM strategies are to be guided by and aligned to the provincial strategy.



3. EMALAHLENI LM SITUATIONAL ANALYSIS

- 3.1. Settlement growth analysis
- 3.2. Population growth analysis
- 3.3. Households and Access to services
- 3.4. Economic overview and Affordability
- 3.5. Temperature and rainfall projections
- 3.6. Temperature Projections
- 3.7. Rainfall projections

3.Emalahleni LM Situational Analysis

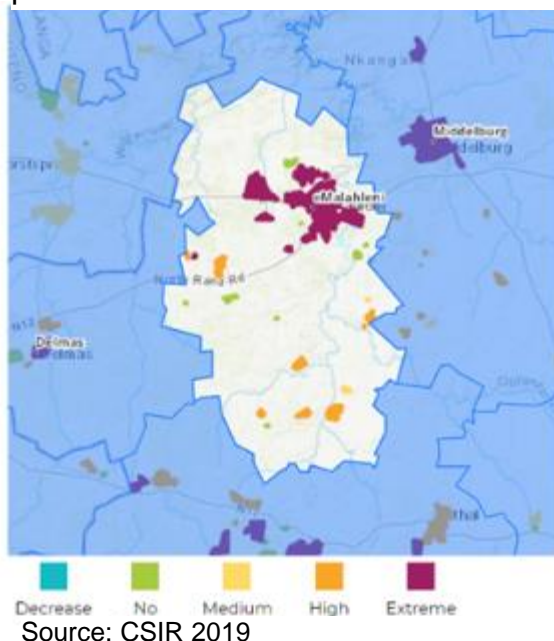
A situational analysis of Emalahleni Local Municipality is a necessary step towards the development of a climate change strategy. It helps to develop an understanding of the climate change challenge facing the municipality and provides a context in which the changing climate can be considered. Climate change response is dependent on the population, household profile, as well as the social and economic activities in the municipality.

The Emalahleni Municipal area consists inter alia of the towns of eMalahleni, Kwa-Guqa, Ga-Nala and Ogies. It is the third largest secondary city in the Mpumalanga Province and the main city centre within the Nkangala District Municipality. This area has the largest concentration of power stations in the country. Emalahleni is probably the most industrialized municipal area in Nkangala and its landscape features mainly underground and opencast coalmines. (Emalahleni Local Municipality, 2020)

The town of eMalahleni fulfils the function of a service centre to the smaller towns and settlements, as well as farms in the district (SACN 2014). As a category B municipality, it is mandated to provide housing, electricity, waste management, roads, transport services as well as water and sanitation in terms of the Water Services Act (108 of 1997).

3.1. Settlement growth analysis

Figure 3: Settlement Growth Pressure points

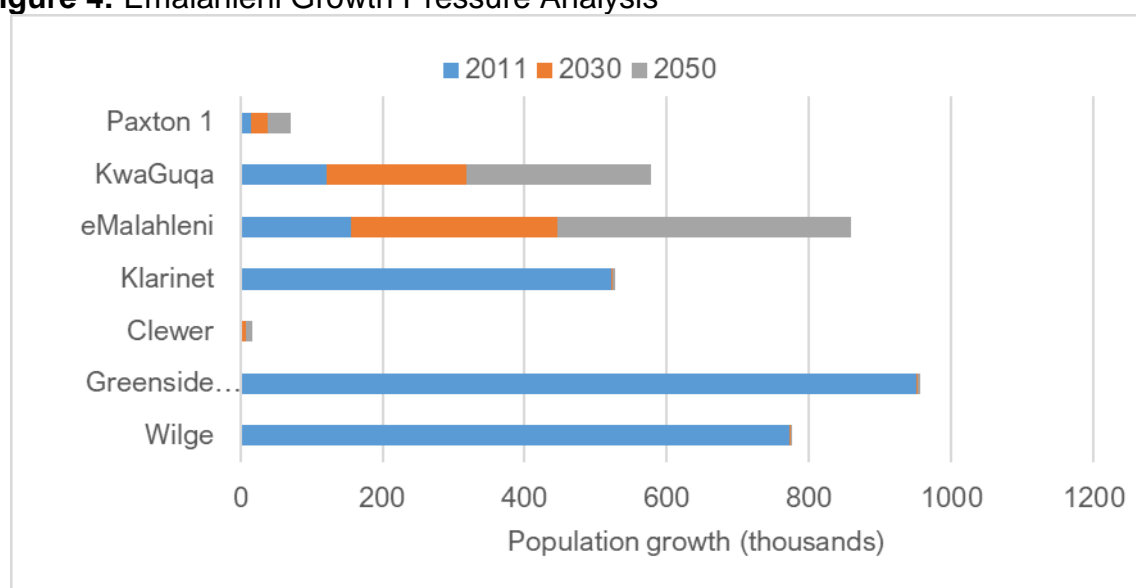


Emalahleni municipality has been experiencing high settlement growth patterns due to rapid urbanisation attributed to its location to various mining and industrial activities attracting migrant labourers. Settlement growth is projected to increase around the city centre and along the urban edge (CSIR 2019). Such a growth projection will place more focus on spatial growth plans around the city centre and will need to consider future energy demand, water and sanitation infrastructure, transportation and housing allocation, making it more important to ensure integration and awareness of climate change (mitigation and adaptation)..

3.2. Population growth analysis

eMalahleni is one of the two towns in Mpumalanga projected to have extreme population growth pressure between 2030 and 2050 (See Figure 4). Its population increased from 395 466 in 2011 to 455 228 in 2016, with a population growth rate of 3.2% per annum (Emalahleni Local Municipality 2020). Emalahleni LM accounted for 32% of the total population living within the Nkangala District Municipality in 2016. Within it, KwaGuqa accounts for the largest portion of the population with a population of 130,920 (33%). This is followed by Emalahleni at 108,673 people (28%) (Emalahleni Local Municipality 2019). The population is projected to be double by 2050 (CSIR 2019). Population growth demands increased resource allocation and development.

Figure 4: Emalahleni Growth Pressure Analysis



Source: (CSIR 2019)

Climate change response planning is impacted more by population growth, as this places pressure on spatial, economic and environmental resources required to build a sustainable society. In addition, the demands of increased population growth serves to places pressure on ageing municipal infrastructure for water and sanitation, electricity supply, roads and human settlements, creating further service delivery challenges and climate change-related disasters in the region.

3.3. Household access to services

Household access to basic services may also guide sector-based climate change response planning and actions. Climate change affects citizens and the spaces that they occupy, therefore, having an understanding of the number of households and the type of household (formal or informal) provides critical information on climate vulnerable communities needed by planners for developing response actions.

The total number of households within Emalahleni LM increased to 150 420 in 2016. This accounts for 36% of the total households in the Nkangala DM, making Emalahleni LM the largest and most populated local authority within this district. Twenty six percent of the total household increase is due to sporadic growth of informal settlements – likely due to inbound migration, motivated by the mining economy in the region (Emalahleni Local Municipality 2020). Informal areas often encroach on open land spaces such as flood plains or steep slopes that are not feasible for residential settlements as the provision of infrastructure needed for water and other services is often not possible or extremely expensive. Growing informal settlements place a strain on disaster risk management and exacerbates climate change hazards and impacts in the area.

3.4. Economic overview

In understanding that climate change results from human-related activities (such as the burning of fossil fuels like coal to power our country, forest clearing and unsustainable agricultural practices etc.), the economic profile of Emalahleni also provides more clarity on the related activities that may be giving rise to high emissions in the area. Emalahleni strongest economic sectors are mining, which contributed more than half of Emalahleni LM's economy at almost 55% in 2017 (Emalahleni Local Municipality 2020).

The size of Emalahleni economy was estimated at R66 billion in 2018, whilst in the same year, 29.8% of the population was regarded as living below the poverty line – R575 per capita per month (StatsSA 2016). Manufacturing is the second-largest sector with a contribution of 9% followed by trade (9%) and finance (8%) respectively. Due to the nature of the mining and energy intensive economy within eMalahleni, the aggregated GHG emissions are significantly higher compared to other municipalities within Nkangala District Municipality and Mpumalanga.

3.5. Temperature and rainfall projections

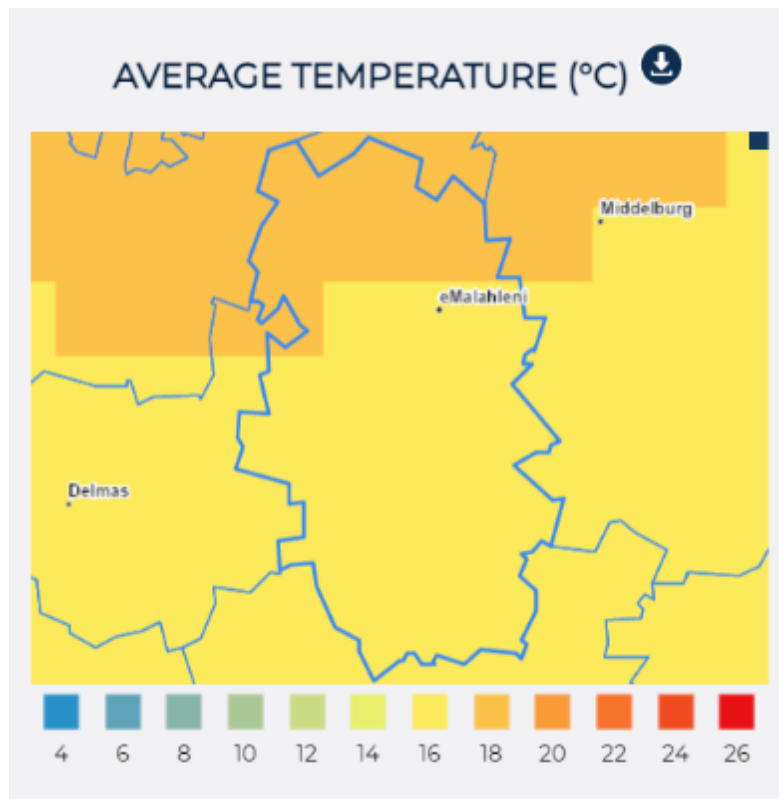
An analysis of the regional climatic conditions covering Emalahleni Municipality was undertaken using the CSIR Green Book tool, using measurements based on an 8X8 km radius distance between each point studied. The projections made are based on a low point of 10% - 90% (the highest coverage point), of the total study area of Emalahleni. Temperature and rainfall are projected at simulated baseline (climatological) state for the period 1961–1990. The projected changes are subsequently projected for the time-slab 2021–2050 relative to the baseline period 1961-2000. Temperature increases are based on a *high mitigation*² scenario represented as RCP 4.5, and a *low mitigation*³ scenario represented as RCP 8.5.

² High Mitigation Scenario represents a situation where there is more interventions towards mitigating the effects of climate change to minimise temperature increase at 1.5 degrees Celsius

³ Low Mitigation scenario represents a situation where no mitigation action is taken, and things are left as they are leading to high temperature increases

3.5.1. Temperature Projections

Figure 5: Emalahleni Average Temperature



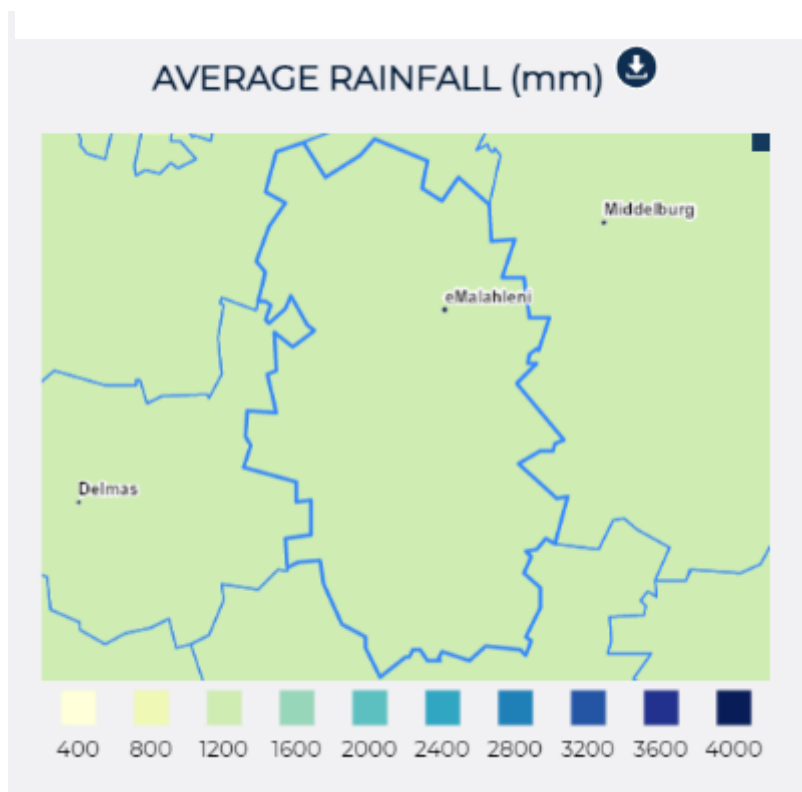
Source: CSIR 2019

levels (RCP 8.5). Very hot days can be expected to last for up to 1-18 days (RCP 4.5) and 1-23 days (RCP 8.5) (CSIR 2019)

Emalahleni municipality experiences a sub-tropical climate with hot summers and cold winters. The average temperature range for the region is 16-18 degrees Celsius. The average *daily* temperature during December, January and February (summer months) is 22.4°C, while over June, July and August (winter months), it is 12.1°C. Recent climate science from within the country indicates that the Emalahleni region, at high mitigation levels (RCP 4.5) could face a potential increase in temperatures by as much as 1°C–2° C between 2021 and 2050, and by 3°C at low mitigation

3.5.2. Rainfall projections

Figure 6: Emalahleni Average Rainfall



Source: CSIR 2019

Emalahleni LM experiences average rainfall of between 700-750mm per annum, with 65% of the rain occurring during the summer, mostly with thunderstorms (Emalahleni Local Municipality 2020). This is below the average rainfall of 1200-1600mm explored by the CSIR Green Book analysis tool. Moreover, the region is likely to experience greater variability in rainfall and will almost certainly witness an increase in evaporation rates. (DARDLEA 2016). Lower rainfall projections coupled with higher temperatures

are a cause for concern as this may indicate prolonged periods of drought, with sporadic heavy rainfalls in between (defined as 20 mm of rain occurring within 24 hours over the 8 x 8 km area covered). This points to the need for alternative water sources and alternative farming methods that will improve groundwater retention or minimise the need for increased water use for irrigation. This also calls for more proactive approaches to disaster management such as inclusive of sustainable spatial planning, incorporating greener buildings with more resilience to heavy rains and flooding



4. EMISSIONS AND ENERGY FOR DEVELOPMENT

- 4.1. Summary of Particulate emissions
- 4.2. Mining Emission Inventory Results
- 4.3. Greenhouse gas emissions
 - 4.3.1. Emissions by fuel
 - 4.3.2. Emissions by Sector
- 4.4. Energy consumption picture for development

4. Emissions and Energy for Development

Emalahleni is one of six local municipalities within the Nkangala District Municipality, in the Mpumalanga province. It is strategically located as a gateway town for eight of the nine provinces of South Africa. The municipality is located to the northeast of the province and accommodates the country's seven coal-fired power stations. A disproportionate share of the country's GHG emissions, therefore, originate from within this locality. The Emalahleni LM falls within the Highveld Priority Area (HPA) (Emalahleni Local Municipality 2019).

4.1. Summary of Particulate emissions

A summary of the particulate emissions⁴ from all available sources reveal that by mass, sulphur dioxide (SO₂) is the largest pollutant emitted within Emalahleni LM followed by nitrous oxide (NO_x) and particulate matter as PM₁₀. Mining activities contribute approximately 58 thousand metric tons of PM₁₀ emissions in the area. Industries (including power stations) are the main contributors of SO₂ and NO_x emissions - 99.87% and 99.84% respectively. Coal mining contributes to the highest levels of PM₁₀ (69.73%), with industries contributing approximately 28.8% and agriculture contributing approximately 1.1%. The largest proportion of carbon monoxide (CO) emissions is produced from the exhausts of internal combustion engines in particular petrol vehicles and vehicles contribute the highest levels of lead emissions (99.21%). Biomass burning (largely as a result of runaway veld fires during the winter season) shows that that considerable emissions (CO, NO_x, PM_{2.5}) emanate from this source. It should be noted that PM_{2.5} emitted by power stations and biomass burning contributes part of the overall PM₁₀ emissions. (Emalahleni Local Municipality 2019).

4.2. Mining Emission Inventory Results

The mining industry in Emalahleni LM consists mainly of coal mines which cover approximately 334 km². Mining activities contribute approximately 58 thousand metric tons of particulate matter (PM₁₀) emissions – the main pollutant emitted by coal mines and other mining related activities such as the use of vehicles on unpaved and paved roads for transporting ore, personnel, waste rock, etc.; blasting; overburden stripping; ore and overburden handling; crushing and screening of ore; and wind entrainment from stockpiles (Emalahleni Local Municipality 2019). Spontaneous combustion of coal occurs within the Emalahleni LM and emissions from this type of coal-burning is

⁴ Studies suggest that short-term exposure to particulate matter leads to adverse health effects, even at low concentrations of exposure (below 100 µg/m³). Morbidity effects associated with short-term exposure to particulates include increases in lower respiratory symptoms, medication use and small reductions in lung function (Scapellato & Lotti 2007). Long-term exposure to low concentrations (~10 µg/m³) of particulates is associated with mortality and other chronic effects such as increased rates of bronchitis and reduced lung function (WHO 2005). Those most at risk include the elderly, individuals with pre-existing heart or lung disease, asthmatics and children.

hard to quantify due to the lack of information (area/volume of coal, period of burning, etc.) available for this type of burning.

4.3. Greenhouse gas emissions

It must be noted that a detailed Greenhouse Gas Emissions Inventory for the Municipality would need to be undertaken in the future to establish a complete municipal energy and carbon emissions picture. This would serve to closely inform the key climate mitigation actions to be taken by the municipality. The results noted in this section do not provide the complete energy and emissions picture of the municipality due to limitations in data access and availability.

Most emissions in Emalahleni LM are due to stationary energy, largely because of electricity consumption by roads, transportation, and the manufacturing sectors, including local steel industries and mining. A large amount of fugitive⁵ emissions is due to the extensive coal mining activities within Emalahleni LM boundaries. It must be noted that Emalahleni LM's induced BASIC⁶ emissions exclude those from the burning of coal to produce electricity for the national grid.

4.3.1. Emissions by fuel

The major fuels responsible for the greater share of carbon emissions include electricity (42%), diesel (38%) and petrol (13%) – attributed to the mining, industrial and commercial economic activities, that have been highlighted in section 4 as the main economic sectors in Emalahleni LM. The emissions from Eskom's power plants situated within the Emalahleni boundaries surpass all other emissions contributions.

4.3.2. Emissions by Sector

Given that energy related emissions (stationary⁷ and transport) contribute to the vast majority of urban carbon emissions, thus an understanding of energy consumption patterns assists in mitigation action planning for climate response. Hence, energy consumption by sector needs to be further explored. The majority of energy is consumed in the transport sector followed by commercial, residential, industrial sectors and solid waste. This is because the transport sector consumes mostly diesel and petrol, while the manufacturing sector consumes largely electricity. Electricity produces more carbon emissions per unit of energy than transport-related fuels. Similarly, the residential, commercial and agricultural sectors, as consumers of electricity rather than petrol or diesel, also produce proportionally more carbon emissions than expected from their energy consumption.

⁵ Fugitive (escaping) emissions from coal and gas industries, e.g. emissions escaping from the ground when mining for coal, or escaping from a natural gas pipeline.

⁶ BASIC refers to emissions that are part of the municipality's own electricity supply area excluding emissions from Eskom power stations and Eskom supplied areas.

⁷ Stationary energy includes electricity consumed by industry, businesses, and households as well as energy generation for manufacturing and construction activities.

4.4. Energy consumption picture for development

Emalahleni LM like every other municipality in the country, consumes electricity generated by coal-fired power stations. Energy consumption is largely by the industrial and manufacturing sectors, followed by the transport sector. The manufacturing sector is a by-product of the coal mines in the region, whose activities require high amounts of energy – energy that is generated from coal. The on-road transport sector, similar to other South African cities, consumes high amounts of energy due to spatial form that has led to the location of public transport users – along the edges of the city centre – in the townships.

As a result, travel distances have always been long between places of work, residence, economic service centres and entertainment. The vast majority of on-road transport energy consumption is by passenger transport and, the use of private cars, which consume the largest proportion of the energy. It takes less energy *per passenger* to move someone who is in a fully-loaded minibus taxi (or a bus) than it does to move someone in a single-occupancy car.

5. FRAMING THE RISK, VULNERABILITY AND HAZARDS PROFILE

- 5.1. Environmental Vulnerability
- 5.2. Socio-economic vulnerability
- 5.3. Economic Vulnerability
- 5.4. Physical Vulnerability
- 5.5. Sector-Based Vulnerabilities, Hazards and Prevailing Impacts
- 5.6. Institutional Vulnerabilities Hindering Climate Response



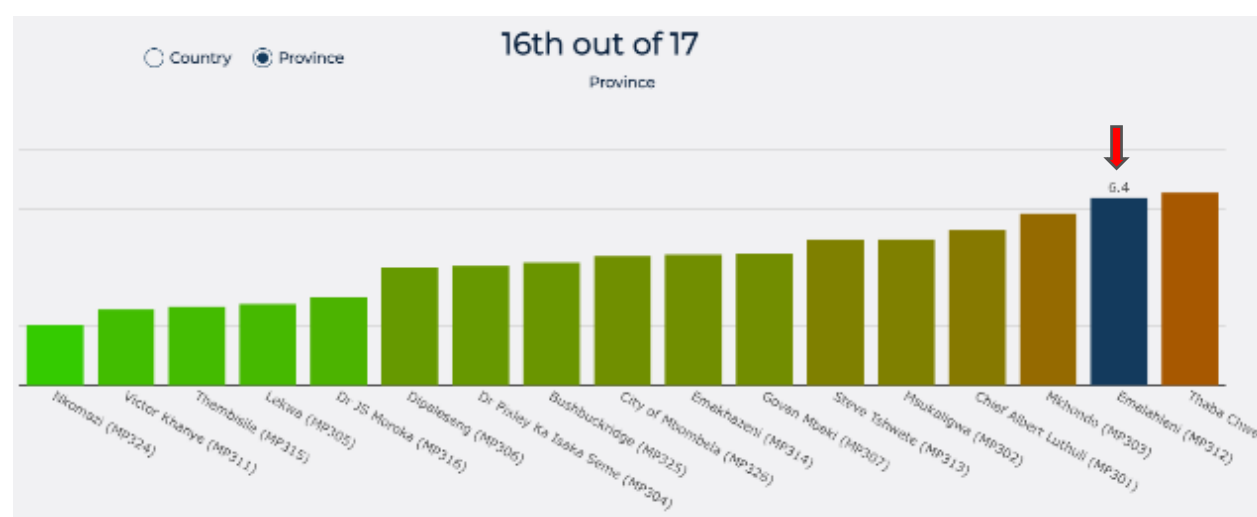
5. Framing the Risk, Vulnerability and Hazards Profile

The risk and vulnerability⁸ profile play a key role in guiding the development of the most suitable climate responses for the municipality. Sectoral based risks and vulnerabilities guide sector-based climate response actions. The risk and vulnerability profile for Emalahleni Local Municipality was developed using the CSIR Green Book resource tool. The tool enables an assessment of risk and vulnerability for sectors within the mandated responsibilities of the municipality and presents data-based evidence findings showing where risk and vulnerability are most prominent and where climate change will likely have significant impacts. Some of the main identified vulnerabilities for the municipality include socio-economic, economic, physical infrastructure and environmental vulnerability. The municipality experiences moderate socio-economic vulnerability and extreme environmental vulnerability. This climate change strategy therefore serves to provide a framework for managing and reducing exposure and vulnerability to hazards, and thus the risk of disaster.

5.1. Environmental Vulnerability

Emalahleni LM scored 6.4 out of 10 in comparison to other municipalities in Mpumalanga province, depicting high environmental vulnerability. Such vulnerability reflects a conflict between preserving the environment and enabling changes in land-use to occur. This also reflects high risk where air quality, environmental governance, and the competition between the ecology and urban encroachment, are concerned.

Figure 7: Emalahleni Environmental Vulnerability Analysis



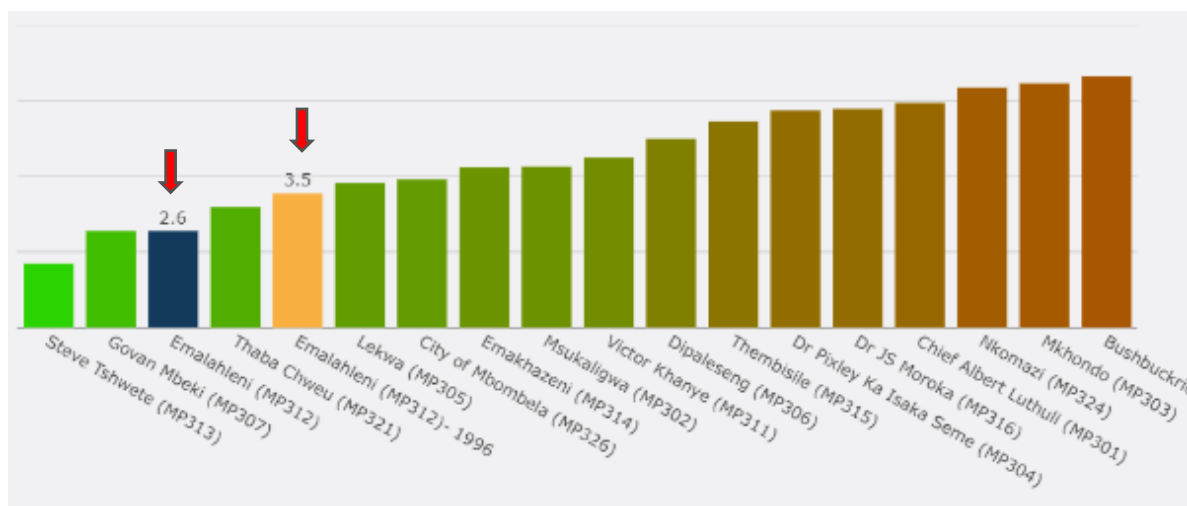
Source: (CSIR 2019)

⁸ Vulnerability is the degree to which a system is susceptible to, and unable to respond to, impacts of climate change. For example, a community with a good storm water drainage system and disaster response unit will be less vulnerable to flooding than a community with no storm water drainage system or disaster response plan

5.2. Socio-economic vulnerability

Emalahleni LM's socio-economic vulnerability improved from 3.5 in 1996 to 2.6 in 2011 out of 10, with 10 being the most extreme case. This means that the living conditions and economic activities improved in scale as a result of an overall improvement in the cost of living in the area. This is supported by the 2016 Mpumalanga community survey data on service delivery access in Emalahleni LM. However, the planned decommissioning of coal mines as per the Integrated Resource Plan (IRP 2019) is anticipated to create much job uncertainty as many of the existing jobs will need to be replaced in the main, by potentially green jobs. This transition will likely result in socio-economic challenges. The municipality will need to ensure that within its medium-long term planning, economic growth takes on a just and equitable form.

Figure 8: Emalahleni Socio-Economic Vulnerability Analysis

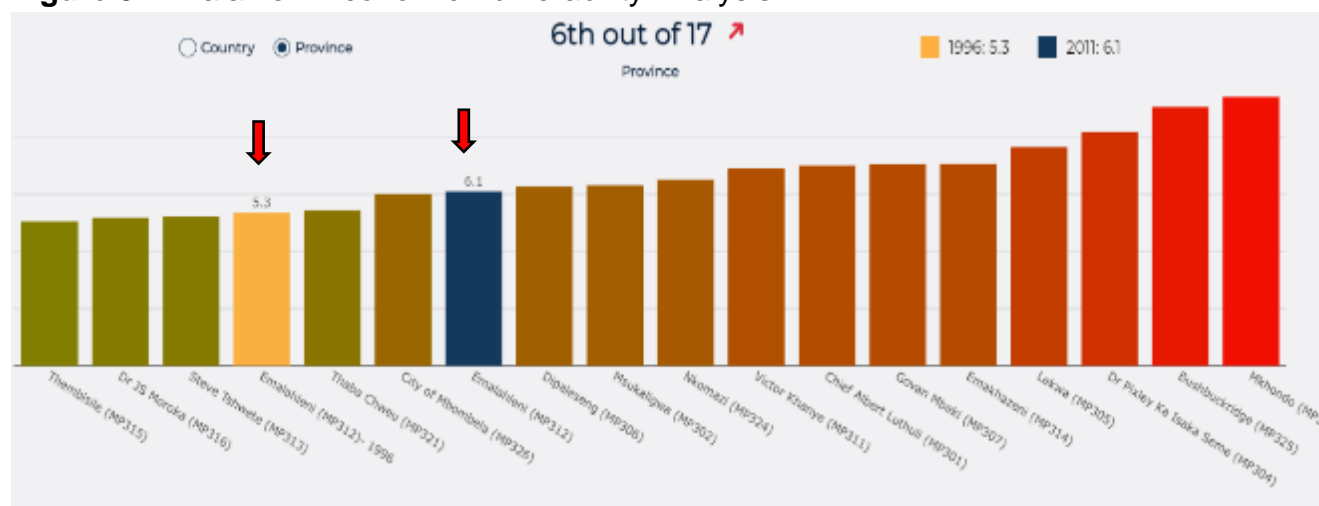


Source: (CSIR 2019)

5.3. Economic Vulnerability

The economic vulnerability regressed from a score of 5.3 in 1996 to 6.1 in 2011 (10 being the most extreme case). This indicates high vulnerability to external economic shocks such as a nationwide recession and other related factors that may impact on the local economy. This means that the municipality's economic activities may not necessarily be growth-centric nor diverse enough to withstand external economic recession – largely due to the high dependence on coal mines which are managed by national government, as well as economic sectors that are also dependent on the mining activities taking place. The picture may slowly change to reflect the energy transition and the decommissioning of coal mines occurring.

Figure 9: Emalahleni Economic Vulnerability Analysis

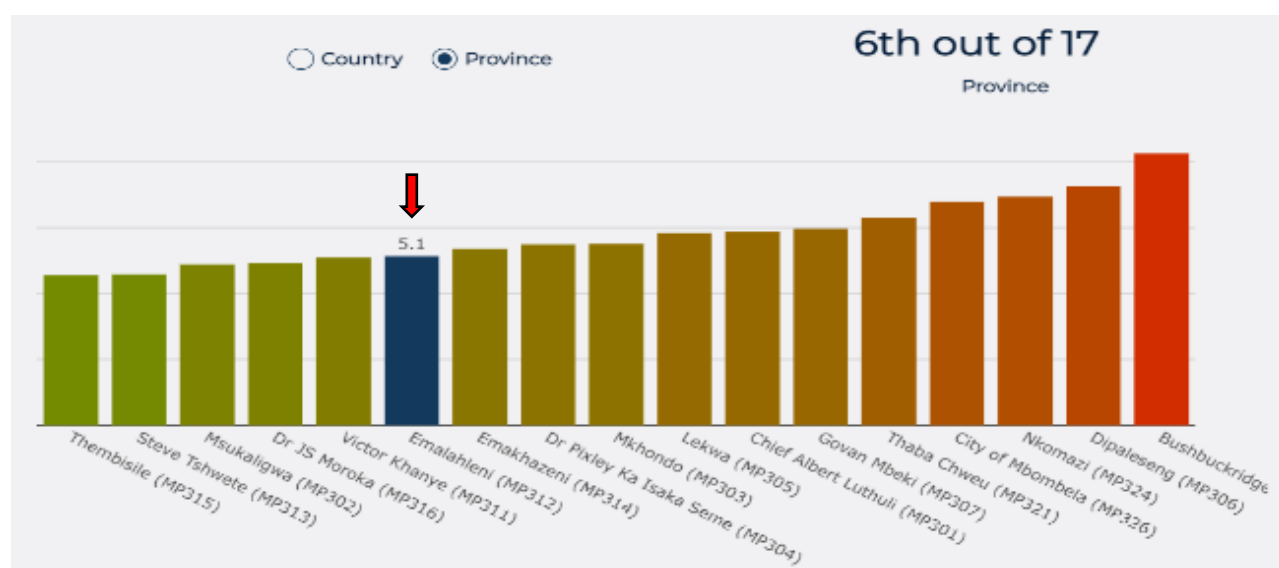


Source: (CSIR 2019)

5.4. Physical Vulnerability

Emalahleni is the most densely populated town and locality within the larger Nkangala district municipality. The municipality's physical vulnerability is indicated by a score of 5.1 out of 10. This is attributed to an increase in illegal land invasions, which have also contributed to the sprawling of informal settlements in and around the main service centres of the town. Its proximity to the country's mines makes it more economically attractive to job seekers and migrant labourers. As a result, though acceptably developed with formally built housing structures, electrification, and a built-up physical environment, it remains at risk of projected future infrastructure service demand.

Figure 9: Emalahleni Physical Vulnerability Analysis



Source: (CSIR 2019)

5.5. Sector-Based Vulnerabilities, Hazards and Prevailing Impacts

5.5.1. Infrastructure Services

a. Energy & Electricity	
Heat Stress	<ul style="list-style-type: none"> ▪ Possibility affects the energy generation infrastructure ▪ Increasing demand for electricity for cooling
Heavy rains/ cyclones/ flooding	<ul style="list-style-type: none"> ▪ Damage to power lines and electricity distribution equipment - can affect economy, social and health
Fires /	<ul style="list-style-type: none"> ▪ Damage to power lines and electricity distribution infrastructure - can affect economy, social and health
Hailstorm	<ul style="list-style-type: none"> ▪ Damage to power lines and electricity distribution infrastructure - can affect economy, social and health
Thunderstorm	<ul style="list-style-type: none"> ▪ Damage to power lines and electricity distribution infrastructure - can affect economy, social and health
Fog	
Frost and cold Stress	<ul style="list-style-type: none"> ▪ Negatively impacts solar energy development
Drought	<ul style="list-style-type: none"> ▪ Increased demand for water for energy generation ▪ Decrease in water to support hydropower generation
Strong/Severe Wind	<ul style="list-style-type: none"> ▪ Damage to power lines and electricity distribution equipment ▪ Disruption of electricity supply - can affect economy, social and health

b. Roads, Transport And Storm Water	
Heat Stress	<ul style="list-style-type: none"> ▪ Impacts the contraction and expansion of the roads ▪ Results in the formation of cracks and potholes ▪ Severe heat and prolonged exposure result in the wearing of tyres ▪ Rail tracks expand and buckle requiring frequent repairs
Heavy rains/ cyclones/ flooding	<ul style="list-style-type: none"> ▪ Exacerbates sinkholes and potholes ▪ Disruption of traffic flow ▪ Damage to roads, bridges and other infrastructure ▪ Delay construction activities ▪ Shorten lifespan of roads ▪ Damage to storm water infrastructure
Fires	<ul style="list-style-type: none"> ▪ Disruption of traffic flow and road closures due to excessive smoke
Hailstorm	<ul style="list-style-type: none"> ▪ Disruption of traffic flow ▪ Damage vehicles
Thunderstorm	<ul style="list-style-type: none"> ▪ Disruption of road traffic flow ▪ Disruption of air travel delays, closure ▪ Damage to electrical equipment e.g., traffic lights, air transport communication equipment
Fog	<ul style="list-style-type: none"> ▪ Disruption of road and air travel
Strong/Severe Wind	<ul style="list-style-type: none"> ▪ Disruption of road and air travel

c. Information, Communications and Technology	
Heat Stress	

c. Information, Communications and Technology	
Heavy rains/ cyclones/ flooding	<ul style="list-style-type: none"> ▪ Damage to ICT infrastructure ▪ Disturbance to network connections, disrupting online services impacting negatively on work that is required - can affect economy, social and health
Fires	<ul style="list-style-type: none"> ▪ Damage to ICT infrastructure ▪ Disturbance to network connections, disrupting online services impacting negatively on work that is required - can affect economy, social and health
Hailstorm	<ul style="list-style-type: none"> ▪ Disturbance to network connections, disrupting online services impacting negatively on work that is required
Thunderstorm	<ul style="list-style-type: none"> ▪ Disturbance to network connections, disrupting online services impacting negatively on work that is required – can affect economy, social and health
Strong/Severe Wind	<ul style="list-style-type: none"> ▪ Damage to ICT infrastructure ▪ Disturbance to network connections, disrupting online services impacting negatively on work that is required - can affect economy, social and health

d. Water Supply and Sanitation	
Heat Stress	<ul style="list-style-type: none"> ▪ Increased demand for water ▪ Increased water losses due to evaporation
Heavy rains/ cyclones/ flooding	<ul style="list-style-type: none"> ▪ Spilling over of dams and rivers, ▪ Erosion lands in dams and river banks, creating debris affecting agricultural livelihoods and biodiversity
Drought	<ul style="list-style-type: none"> ▪ Reduce water available to support economic activities and human settlements ▪ Decrease in streamflow ▪ A decline in water quality / Increased salinity of surface and ground water ▪ Water shortages and restrictions

5.5.2. Environmental Management Services

a. Waste Management	
Heat Stress	<ul style="list-style-type: none"> ▪ An increased chemical reaction of pollutants ▪ increases combustibility of waste material ▪ Affects waste collection
Heavy rains/ cyclones/ flooding	<ul style="list-style-type: none"> ▪ Excessive rain causes damage/disruption of waste management and water treatment plants ▪ Affects waste collection
Fires	<ul style="list-style-type: none"> ▪ Waste material becomes a very dangerous fuel source during
Hailstorm	<ul style="list-style-type: none"> ▪ Affects waste collection, transportation and disposal
Thunderstorm	<ul style="list-style-type: none"> ▪ Affects waste collection, transportation and disposal
Fog	<ul style="list-style-type: none"> ▪ Reduced visibility and further affects turn-around time for both Collection transportation and Disposal
Frost and cold Stress	<ul style="list-style-type: none"> ▪ Threatens the health of workers due to reduced visibility ▪ It slows down the speed of waste collection
Drought	<ul style="list-style-type: none"> ▪ Threatens biodiversity and the natural ecosystem escalates the drying up of vegetation that is essential during heavy rains or winds.

a. Waste Management	
	<ul style="list-style-type: none"> Exacerbates run-off during rainy periods
Strong/Severe Wind	<ul style="list-style-type: none"> Wind-blown litter

b. Air Quality	
Heat Stress	<ul style="list-style-type: none"> A decline in air quality (High emission)
Heavy rains/ cyclones/ flooding	<ul style="list-style-type: none"> Leads to acid rain due to abandoned mines
Fires	<ul style="list-style-type: none"> Increase in CO₂
Hailstorm	<ul style="list-style-type: none"> Similar impacts as rain (acid rain)
Thunderstorm	<ul style="list-style-type: none"> Similar impacts as rain (acid rain)
Fog	<ul style="list-style-type: none"> Reduced visibility
Frost and cold Stress	
Drought	<ul style="list-style-type: none"> Increases the chances of dispersion of particulate matter and dust
Strong/Severe Wind	<ul style="list-style-type: none"> Increases the chances of dispersion of particulate matter and dust

c. Biodiversity Ecosystems and Natural Vegetation	
Heat Stress	<ul style="list-style-type: none"> Loss of biodiversity Increased exposure of land leaving it more vulnerable to erosion Migration of species Can increase the risk and spread of pathogens, pests, and diseases Increased evapotranspiration
Heavy rains/ cyclones/ flooding	<ul style="list-style-type: none"> Increased erosion and gulley formation Transformation of biomes Change in corridors and affecting species distribution, diversity and richness
Fires	<ul style="list-style-type: none"> Loss of biodiversity Increases the chances of invasion by alien plants
Hailstorm	<ul style="list-style-type: none"> Loss of biodiversity Increases the chances of invasion by alien plants
Thunderstorm	<ul style="list-style-type: none"> Loss of biodiversity Increases the chances of invasion by alien plants
Frost and cold Stress	<ul style="list-style-type: none"> Loss of biodiversity Increases the chances of invasion by alien plants
Drought	<ul style="list-style-type: none"> Extinction of plants and animals Shifts in biome composition Loss of aquatic species
Strong/Severe Wind	<ul style="list-style-type: none"> Increases the chances of invasion by alien plants

5.5.3. Community Safety

a. Public Health	
Heat Stress	<ul style="list-style-type: none"> Human discomfort Increased risk of vector-borne diseases e.g., malaria Increased risk for cardiovascular and respiratory diseases Increased demand for energy for cooling

a. Public Health	
	<ul style="list-style-type: none"> Increases extent of areas with conditions conducive to vectors and pathogens Increased demand for public health services
Heavy rains/ cyclones/ flooding	<ul style="list-style-type: none"> Increased risk of water-borne diseases e.g. cholera Reduce the availability of safe food and drinking water
Fires	<ul style="list-style-type: none"> Injuries and loss of human life Loss of health services infrastructure Increase in respiratory diseases
Hailstorm	<ul style="list-style-type: none"> Injuries and loss of human life Loss of health services infrastructure
Thunderstorm	<ul style="list-style-type: none"> Endangerment of humans and loss of human life Damage to infrastructure
Fog	<ul style="list-style-type: none"> Respiratory discomfort
Frost and cold Stress	<ul style="list-style-type: none"> Increased risk of extreme cold-related diseases
Drought	<ul style="list-style-type: none"> Increased malnutrition and food security
Strong/Severe Wind	<ul style="list-style-type: none"> Endangerment of humans and loss of human life Damage to infrastructure

b. Law Enforcement and Safety	
Heat Stress	<ul style="list-style-type: none"> Increased demand for officials to support affected communities and those at risk
Heavy rain and cyclones resulting in flooding	<ul style="list-style-type: none"> Places strain on the municipal capacity to provide emergency services in affected communities and those at risk
Fires	<ul style="list-style-type: none"> Places strain on the municipal capacity to provide emergency services in affected communities and those at risk
Thunderstorm	<ul style="list-style-type: none"> Increased demand for officials to support affected communities and those at risk
Drought	<ul style="list-style-type: none"> Increased demand for officials to support affected communities and those at risk
Strong/Severe Wind	<ul style="list-style-type: none"> Increased demand for officials to support affected communities and those at risk

c. Disaster Management Emergency Services	
Heat Stress	<ul style="list-style-type: none"> Increased demand for and expenditure on disaster management /emergency response
Heavy rain and cyclones resulting in flooding	<ul style="list-style-type: none"> Disruption of social activities such as education, work and recreation Displacement of settlements, leaving people exposed to harsh weather elements
Fires	<ul style="list-style-type: none"> Disruption of social activities such as education, work and recreation Displacement of settlements, leaving people exposed to harsh weather elements
Hailstorm	<ul style="list-style-type: none"> Damage to infrastructure and personal belongings
Thunderstorm	<ul style="list-style-type: none"> Damage to infrastructure and personal belongings
Drought	<ul style="list-style-type: none"> Increase susceptibility to famine, and disease Demand for and expenditure on disaster management /emergency response
Strong/Severe Wind	<ul style="list-style-type: none"> Damage to infrastructure and personal belongings

- Increased demand for and expenditure on disaster management /emergency response

5.5.4. Spatial Planning and Human settlements

a. Spatial Planning and Land Use Management

Heat Stress	<ul style="list-style-type: none"> ▪ Increases the cost of planning to incorporate alternative construction material that allows for cooling
Heavy rain and cyclones resulting in flooding	<ul style="list-style-type: none"> ▪ Improper delineation of settlements from watercourses. ▪ Increased cost for planning to incorporate protective measures to minimise vulnerability to floods
Fires	<ul style="list-style-type: none"> ▪ Increased cost for planning to incorporate alternative construction materials to minimise vulnerability to fires
Hailstorm	<ul style="list-style-type: none"> ▪ Increased cost for planning to incorporate protective measures to minimise vulnerability to hailstorms
Drought	<ul style="list-style-type: none"> ▪ Cost of installation of water supply systems
Strong/Severe Wind	<ul style="list-style-type: none"> ▪ Increased need to install wind buffers and regenerative landscaping within urban settlements

5.5.5. Local Economic Development

a. Food Security and Agriculture

Heat Stress	<ul style="list-style-type: none"> ▪ Increased water use by plants and animals ▪ Increased vulnerability of livestock to disease, reduced fertility and milk production in dairy cattle and ▪ Reduced crop productivity ▪ Impact on animal-human Health ▪ Reduced water availability due to high evaporation ▪ Can increase the risk of pathogens, pests and diseases
Heavy rain and cyclones resulting in flooding	<ul style="list-style-type: none"> ▪ Damage to crops and loss of livestock –leading to food insecurity ▪ Increases soil salinity ▪ Soil erosion and land degradation ▪ Increases the chances of migratory pathogens
Fires	<ul style="list-style-type: none"> ▪ Damage to crops and loss of livestock –leading to food insecurity
Hailstorm	<ul style="list-style-type: none"> ▪ Damage to farming equipment and crops ▪ Increasing cost of farming, leading to increased price- Food insecurity
Thunderstorm	<ul style="list-style-type: none"> ▪ Disrupt food distribution when roads are inaccessible
Frost and cold Stress	<ul style="list-style-type: none"> ▪ Damage to some crops
Drought	<ul style="list-style-type: none"> ▪ Less water available for rain fed and irrigated agriculture ▪ Over-abstraction of surface and groundwater for irrigation ▪ Increased food insecurity ▪ Increased food prices ▪ Less forage available for grazing livestock
Strong/Severe Wind	<ul style="list-style-type: none"> ▪ Increases the cost of infrastructure

b. Commercial and Industry	
Heat Stress	<ul style="list-style-type: none"> ▪ Increased demand for energy for cooling
Heavy rain and cyclones resulting in flooding	<ul style="list-style-type: none"> ▪ Increased costs of insurance ▪ Disruption of commercial activities
Fires	<ul style="list-style-type: none"> ▪ Damage to/loss of critical infrastructure
Hailstorm	<ul style="list-style-type: none"> ▪ Damage to/loss of critical infrastructure ▪ Increased costs of insurance
Thunderstorm	<ul style="list-style-type: none"> ▪ Disruptions to telecommunication networks, affecting business operations
Frost and cold Stress	<ul style="list-style-type: none"> ▪ Increased demand for energy
Drought	<ul style="list-style-type: none"> ▪ Less water available to support industrial activities
Strong/severe Wind	<ul style="list-style-type: none"> ▪ Disruption of commercial activities ▪ Disruptions to telecommunication networks, affecting business operations

c. Tourism	
Heat Stress	<ul style="list-style-type: none"> ▪ Increases cost to maintain the property and maintain hospitable circumstances ▪ Increased demand for energy for cooling
Heavy rain and cyclones resulting in flooding	<ul style="list-style-type: none"> ▪ Destruction to tourism infrastructure ▪ Disruptions to tourism services such as transportation, bookings etc.
Fires	<ul style="list-style-type: none"> ▪ Damage/loss of tourism infrastructure
Hailstorm	<ul style="list-style-type: none"> ▪ Damage/loss of critical infrastructure ▪ Increased costs of insurance
Thunderstorm	<ul style="list-style-type: none"> ▪ Disruptions to telecommunication networks, affecting business operations
Frost and cold Stress	<ul style="list-style-type: none"> ▪ Increased demand for energy
Drought	<ul style="list-style-type: none"> ▪ Increased demand for water, loss of tourists ▪ Loss of revenue due to decreased number of tourists

5.6. Institutional Vulnerabilities Hindering Climate Response

It is a well-known phenomenon that for all systems and processes to seamlessly operate within a municipality, governance and intergovernmental relations need to be at a level that begets confidence amongst communities and all other stakeholders within the municipal value chain. Institutional vulnerabilities refer to internal systematic weakness that hinder efficient service delivery, and overall efficient functionality of the institution. Some of the cross-cutting vulnerabilities in the municipality include inadequate institutional capacity, lack of institutional memory, challenges in managing external stakeholders, and inadequate financial resources. Inadequate institutional capacity in this instance also includes a lack of political will and decisive governance. There is a need to strengthen intergovernmental relations between the local

municipality, the district municipality and provincial sector departments. Detailed sector-specific vulnerabilities have also been identified in the table below.

Table 1: Sector-Specific Institutional Vulnerabilities

Many of the challenges outlined in the table below were derived from sector specific climate change consultation workshops held with the municipality during the Climate Change Strategy development process.

Directorate	Challenges identified	Responsible internal stakeholders
Development Planning (IDP) and Finance	<ul style="list-style-type: none"> Challenges with integrated coordination of all sector plans in the IDP Climate response planning previously not integrated in the IDP 	<ul style="list-style-type: none"> All departments/units in the municipality
Electricity and Energy	<ul style="list-style-type: none"> Service delivery projects receive priority which limits the ability to explore investment based projects Budget constraints and lack of stakeholder involvement 	<ul style="list-style-type: none"> Technical Services unit Spatial Planning and IDP unit Local Economic Development Unit Finance unit
Spatial Planning and Human settlements	<ul style="list-style-type: none"> Budgets constraints negatively impact the availability of key planning-related resources/tools Delays in finalising the LM's SDF which is an important planning tool for the municipality Essential to integrate climate change response in the various sectors within the municipality The municipality lacks a GIS system that would crucially assist in future planning within the municipality 	<ul style="list-style-type: none"> All departments/units in the municipality
Local Economic Development	<ul style="list-style-type: none"> Lack of capacity within the LM to drive agricultural and tourism-related projects. Lack of coordination between District and ELM on agricultural projects. 	<ul style="list-style-type: none"> Technical Services unit Spatial Planning and IDP unit Local Economic Development Unit Finance unit
Environmental Management (Including Waste Management)	<ul style="list-style-type: none"> Insufficient budget to respond to all environmental issues Lack of coordination within the directorate and other directorates in the municipality Lack of communication that conveys key environmental management issues 	<ul style="list-style-type: none"> Waste and Environmental Services Environmental management & compliance Spatial Planning and IDP unit Finance unit
Community Safety	<ul style="list-style-type: none"> Shortage of fire fighting vehicles 	<ul style="list-style-type: none"> Community safety unit Environmental management & compliance

Directorate	Challenges identified	Responsible internal stakeholders
	<ul style="list-style-type: none"> High frequency of fires in winters due to increased occurrences of dry weather and dry vegetation 	<ul style="list-style-type: none"> Spatial Planning unit IDP unit Finance unit
Disaster Management	<ul style="list-style-type: none"> Reliance on the District Municipality for fire equipment and firefighting resources Challenges with issuing operating permits for mines 	<ul style="list-style-type: none"> By-Laws Enforcement Unit Disaster management unit Environmental management & compliance Spatial Planning unit IDP unit Finance unit
Water and Sanitation	<ul style="list-style-type: none"> Inability to finance projects through own funding (low revenue collection) Inability to implement projects through loan funding Limited grant allocations to alleviate the existing backlog and strategic projects Shortage of critical skills (e.g., engineers) Institutional arrangement (no planning division) 	<ul style="list-style-type: none"> Technical Services Directorate Water and sanitation and Project Management Unit Finance unit
Roads and Storm water	<ul style="list-style-type: none"> Financial affordability. Institutional capacity to handle high capital projects. Institutional arrangement (e.g. establishment of Engineering and Planning unit). Shortage of engineering skills 	<ul style="list-style-type: none"> Technical Services Directorate Roads and Storm water Project Management Unit Finance unit



6. EMALAHLENI'S CLIMATE CHANGE STRATEGY

6.1. Problem Statement

6.2. Local government mandate relevant to climate change

6.3. Purpose of developing a Climate Change strategy

6.4. Climate Change Strategy Vision, Mission
and Objectives

6.4.1. Vision

6.4.2. Mission

6.4.3. Objectives

6.5. Climate change integration into the IDP

6.Emalahleni's Climate Change Strategy

6.1. Problem Statement

Emalahleni Local Municipality is located at the heart of coal mining region in South Africa. The municipality experiences high levels of harmful air pollution and greenhouse gas emissions associated with mining and industrial activities⁹. South Africa's NDP explicitly points to the greater Mpumalanga Highveld (of which eMalahleni is a part), as an area contributing "disproportionately to greenhouse gas emissions and air pollution in South Africa" (NPC 2011). Emalahleni also faces incidences of drought, heavy rains, increasing temperatures and associated runaway fires due to changing climatic conditions. The impacts from climate change are envisaged to continue with increased severity and devastation, considering the dire socio-economic aftermath of the COVID-19 pandemic. Climate change plays itself out very differently at the local level, requiring locally specific responses. Climate impacts already experienced at the local level include damage to property and infrastructure from flooding, food insecurity from crop failure because of both drought and flooding, ill-health from vector-borne and waterborne diseases and air quality and pollution related impacts are some of the many impacts afflicted by climate change.

Science demonstrates the enormous uncertainty around how the changes in greenhouse gas (GHG) concentrations in the atmosphere will impact our weather and climate systems. While the climate science base is evolving all the time, planning conditions will be far more uncertain than in the past. To this end, developing a climate change strategy is a key step for a municipality to strategically plan and respond to climate change. A climate change strategy is required to provide a framework to integrate climate change response in localised sector-based strategies that can be incorporated into the IDP for implementation. 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' to systems or infrastructure not suitable to future climate conditions.

The consequences of failure to adapt to and mitigate climate change will be substantial. It is therefore in the Emalahleni's best interests to take bold action now to avoid the worst impacts of climate change, through adaptation and mitigation. While the timing and magnitude of impacts will always remain to some extent uncertain due to limitations in climate modelling at the scale of a municipality, little uncertainty remains regarding the types of impacts that Emalahleni is facing and will increasingly face in the future. Various studies have shown that the costs of early and proactive

⁹In 2007 the Minister of Forestry, Fisheries and the Environment declared the greater Emalahleni region as a national air pollution hotspot called the Highveld Priority Area (HPA) in terms of the National Environmental Management: Air Quality Act (39 of 2004). In terms of this declaration the national government is responsible for monitoring, managing, and mitigating air pollution, in conjunction with local and provincial governments (SACN, 2014).

action will be far less than delayed action or inaction (DEA, 2011). As a result, proactive planning, and implementation to address anticipated impacts will be far more cost effective and practical in the long term. Moreover, actions taken to reduce emissions have many co-benefits. They will increase social and economic resilience and productivity, ensure better access to public transport, promote a healthier urban environment, and ensure a more economically viable and cleaner energy system.

If steps are not taken to adapt to the predicted impacts of climate change and contribute to global efforts to mitigate climate change, several impacts will be experienced with increasing intensity, severity, and frequency, as well as several missed opportunities. These impacts and missed opportunities include:

- Drought and associated water shortages.
- Flooding and associated impact on people and infrastructure.
- Heat stress and associated health impacts.
- Damage to infrastructure and property due to severe storms and strong winds.
- Increased risk of fire, affecting both the natural environment and urban areas.
- Loss of biodiversity and associated loss of ecosystem goods and services.
- Loss of agricultural productivity in the region and associated impacts on food security.
- A missed window of opportunity to facilitate an inclusive green transition and thus deliver essential services in a more sustainable manner while creating employment opportunities in a new economy.
- Increased vulnerability to volatile oil prices and economic risks associated with investments in coal, fossil fuels and associated infrastructure that could see taxes or embargoes imposed on Emalahleni's goods and services by trade partners

These anticipated impacts have the potential to affect all forms of service delivery, with impacts likely to be more severe in areas and sectors that are at a higher risk due to high levels of vulnerability and low levels of resilience and adaptive capacity.

This strategy aims to address these identified impacts within the municipal mandates and spheres of influence and to ensure that the municipality can address the challenges posed by climate change and avoid locking itself into unsustainable investments or development pathways.

6.2. Local government mandate relevant to climate change

Climate change is a dimension that has strong relevance in local government's ability to meet its Constitutional objectives (Section 152 (1)) of sustainable service delivery, social and economic development, and the promotion of a safe and healthy environment.

The Constitution of South Africa (108 of 1996); the Local Government White Paper (2006); the Municipal Systems Act (32 of 2000) and the Municipal Structures Act (117

of 1998) assign municipalities a host of responsibilities that broadly speak to the provision of services at a local level. In this context, municipalities are tasked with creating an environment that facilitates economic opportunities, the provision of free basic services for the poor and investment in infrastructure. Schedules 4 and 5 of the Constitution (1996) refer to a host of municipal powers and functions, which essentially allocate sector-based responsibilities to municipalities for a combination of direct service provision functions, regulation, and management of partnerships with various relevant stakeholders. Such local government powers and functions outlined in Schedule 4 and 5 relating to building codes, land use planning, water, storm water and sanitation, electricity, infrastructure, parks and conservation, waste management, transport, air quality, human settlements and disaster management are all broad areas of responsibility within which specific climate response actions fall.

In addition, the National Climate Change Response Paper White Paper (NCCRP) (2011), South Africa's blueprint for responding to climate change, in its Section 10.2.6 delineates the key role of local government as a site of climate response delivery flowing from its responsibilities as detailed in the objectives and powers and functions accorded to local government in the Constitution, the Municipal Systems and Structures Acts mentioned above. The NCCRP further identifies the climate response areas of local government as 1) building resilience within the local population, 2) planning settlements in the context of climate change, 3) urban development, 4) provision of infrastructure and services and 5) water and energy demand management.

A further local government directive relevant to climate response is one where local government must adhere to environmental principles and take environmental considerations into account in its planning processes. Some significant principles contained in the National Environmental Management Act (NEMA) (107 of 1998) and the White Paper of Environmental Management Policy for South Africa include, that local planning must take into account global/international issues (GHG emissions would be a good example of this, having little immediate local impact, but substantial impact when combined with all global contributions), that this must be brought into planning as early as possible and that natural resources must be protected for the benefit of present and future generations.

6.3. Purpose of developing a Climate Change strategy

It is globally understood that climate change poses the greatest risk to socio-economic stability and growth (WEF 2019; McKinsey Global Institute 2020), and is increasingly affecting Emalahleni Local Municipality. This strategy recognizes that responding to climate change and dealing with its impacts will be difficult and that significant changes will be necessary. To this end, this strategy provides a framework and the strategic direction for Emalahleni in integrating climate response into the municipal (IDP) planning to ensure alignment of key municipal policies, strategies and plans with climate change concerns. This is not a new planning or reporting requirement. It offers

a means of identifying and prioritizing actions to meet new challenges and adjust existing planning and projects to changing weather conditions and economic constraints around fossil fuels. This will also enable short to medium term actions to be taken and budgeted for. The strategy will be the gateway towards deliberate climate response inclusion in the various sector plans that the municipality is required to have. Climate integration into sector development brings tangibility to the meaning of climate response at a local level and enables lobbying to be done for climate inclusive project planning. It also integrates climate change response in the day-to-day activities of the municipality. A climate change strategy will enable the municipality to plan and to respond appropriately – to identify the key contributors in Emalahleni's climate change status and to propose means for mitigation and adaptation, for the municipality to reduce climate-induced disasters. The climate change strategy will enable climate response decision-making as well as the strategic direction for action planning and implementation.

Part of the municipal mandate is to also ensure sufficient resources for disaster management and to make communities aware of climate change impacts. This requires that the municipality prepares climate responsive plans. The municipality has recently developed its disaster management plan, which has identified priority areas in managing disasters for the municipality concerning infrastructure services that the municipality provides (Emalahleni Local Municipality 2020).

Having a clear climate change strategy enables the municipality to take action to reduce and prepare for these risks (adaptation). This strategy requires the municipality to work differently and more collaboratively and is, therefore, designed to provide a framework to encourage and assist directorates to do this more effectively. The strategy further enables the municipality to adopt an integrated approach to climate change response and recognize that climate change is a key risk to the economy, society, and environment.

Emalahleni municipality recognises that it does not exist in isolation from the surrounding region but is dynamically related to the surrounding region with respect to water, food and energy supply, tourism, and other economic activities, and therefore needs to engage with partners beyond its borders, including national and provincial government as well as other municipalities. The municipality also acknowledges that for this strategy to be effective, the municipality must work closely in partnership with residents, businesses, NGOs, academia, other spheres of government, and other partners across the municipality. This strategy as a result provides clarity on the municipality's policy position and priorities regarding climate change.

It is recognised that while this strategy established the municipal vision for responding to climate change, it will require a long-term and phased approach to ultimately achieve this vision. This strategy serves as a key step in taking the municipality forward towards the vision. Future revisions of this strategy will be informed by the

evolving climate science, tracking of implementation progress and global best practice.

6.4. Climate Change Strategy Vision, Mission and Objectives

6.4.1. Vision

To be a people-centered and innovative local municipality that is responsive to the impact of climate change, through building climate resilience, resource efficiency and carbon neutrality.

6.4.2. Mission

Building climate-resilient communities through sustainable delivery of services that promotes smart and inclusive economic and social development and environmental sustainability.

6.4.3. Objectives

Emalahleni's IDP Strategic Focus Areas

The strategic objectives of the Municipal IDP that guide planning, operations and development in the municipality are:

- To provide support, advice and facilitate through alignment of the institutional arrangements
- To provide access to habitable, sustainable and affordable integrated human settlements
- To increase access to efficient and sustainable basic services
- To provide an enabling environment for social and recreational development
- To create a clean, healthy and safe sustainable environment
- To create an attractive and conducive environment for sustainable economic development and tourism
- To promote spatial concentration and facilitate, manage and control integrated land use and spatial planning
- To strengthen good governance and public participation
- To ensure sound financial and asset management
- To ensure sustainable provision of suitable transport

Strategic objectives of the Climate Change Strategy

The climate change strategic objectives have been developed to closely align with the strategic objectives that the municipality is founded on and operates under, as articulated in the municipal Integrated Development Plan. Such alignment at the very outset is essential to enable the process of mainstreaming climate-responsive action into the overarching vision and developmental objectives of the municipality. To this

end, the climate change strategy objectives are broadly categorized according to the key strategic development areas embraced by the municipality, and therefore directly positioned to respond to climate change in the municipality.

Table 2: Emalahleni Local Municipality Climate Change Strategic Objectives

Municipal Strategic Focus Area	Climate Change Response Objectives
Governance	<ul style="list-style-type: none"> • To be accountable and committed to addressing socio-economic needs from a climate change response perspective. • To mainstream and lead climate change response through municipal policy programmes, plans and by-laws in the municipality. • To be responsive and proactive to the Just Transition and the Fourth Industrial Revolution¹⁰. • To be inclusive and transparent with all municipal stakeholders about climate action response.
Environment	<ul style="list-style-type: none"> • Build environmental resilience by identifying and spatially mapping climate vulnerabilities for effective response action planning. • Improve the management of air quality, biodiversity, water and land pollution to minimise climate change impacts.
Social	<ul style="list-style-type: none"> • Build and strengthen socio-economic resilience in communities, through access to livelihoods, basic services, and climate safe locations, thereby enhancing their ability to prepare, adapt and recover from climate shocks and stresses.
Infrastructure	<ul style="list-style-type: none"> • To build resilient climate-sensitive and sustainable infrastructure informed by identified vulnerabilities and key response actions in municipal plans and strategies. • Improve the management of scarce water resources and biodiversity in water catchment areas.
Economy	<ul style="list-style-type: none"> • Adopt energy efficiency and sustainable energy as economic development catalysts towards a strengthened circular economy. • To integrate principles of a Just Transition into municipal local economic development plans, promoting a local economy that is just and supports environmentally sustainable economic investments – low carbon and employment creating opportunities.

6.5. Climate change integration into the IDP

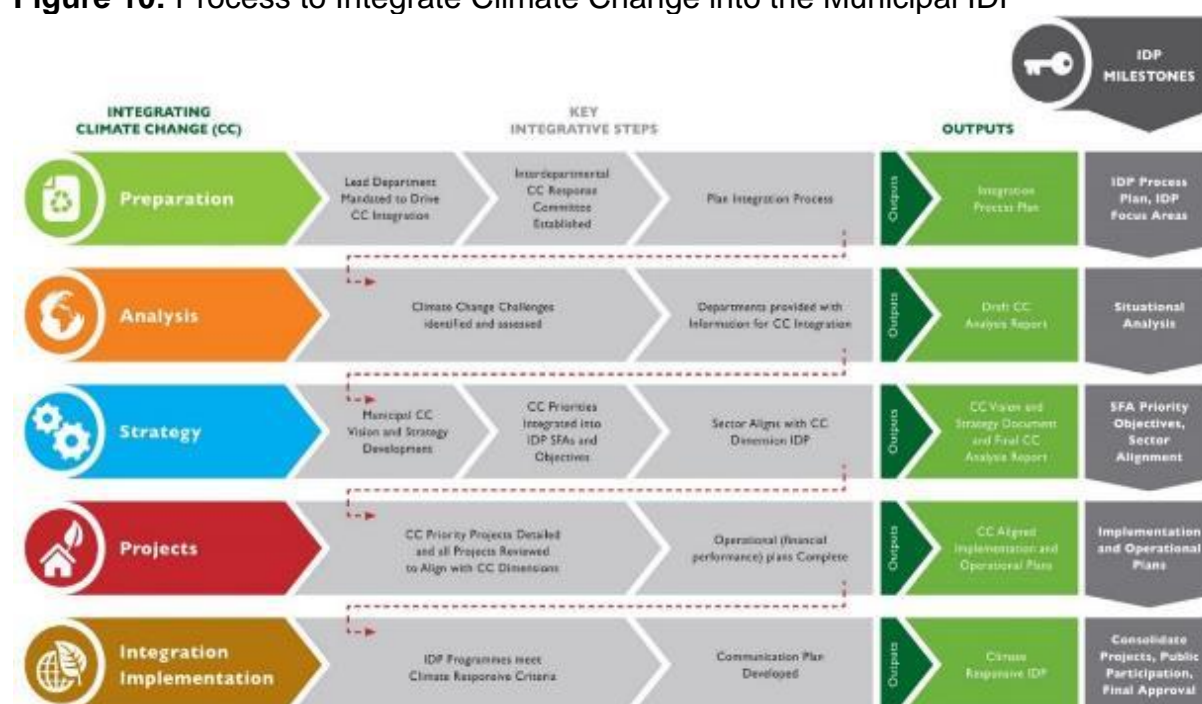
The Integrated Development Plan (IDP) is the master plan for municipal planning and budgeting, which enables municipalities to prioritize developmental issues in consultation with communities. The development of the IDP is a subsequent phase of planning that serves to unite the total efforts of the municipality in integrating its operational activities successfully. This necessitates the involvement of senior officials to assume responsibility and cohesion among councillors, communities, stakeholders,

¹⁰ Technology is rapidly developing, entering the Fourth Industrial Revolution. New or rediscovered technological developments are reshaping every value chain or aspect of life, with major implications on economic activities, the world of work and social cohesion (Schwab 2015).

linking the IDP to budgetary processes and prioritizing projects and programmes. The IDP development and implementation process aligns operational activities of all municipal departments. This forms the premise for integrating climate change into the IDP of Emalahleni to ensure that it becomes mainstreamed and specific climate response actions are developed, committed to, budgeted for, and implemented – in order to realise the municipal objectives towards adapting to climate impacts and limiting the degree of climate change through the reduction of greenhouse gas emissions in the region.

Integrating climate change response into a municipal IDP offers a means of identifying and prioritising actions to meet new challenges and adjusting existing planning and projects to changing weather conditions and economic constraints around fossil fuels.

Figure 10: Process to Integrate Climate Change into the Municipal IDP



Source: (DEA 2012)



7. EMALAHLENI CLIMATE RESPONSE APPROACH

7.1. Climate Response overview

7.2. Adaptation and Mitigation responses

7.2.1. Potential Adaptation Responses for
Emalahleni

7.2.2. Potential Mitigation Responses for
Emalahleni

7.3. Climate Change Crosscutting Responses

7.4. Sector Climate Change Response Actions
(mitigation and adaptation)

7.Emalahleni Climate Response Approach

7.1. Climate Response overview

Emalahleni's climate change strategy, guided by the National Climate Change Response Policy, aims to transit to a lower carbon and climate-resilient society and objectively manage climate change impacts. To coordinate local adaptation and mitigation action across its line departments, climate change considerations and constraints should be integrated into municipal development planning tools such as Integrated Development Plans (IDPs), and municipal service delivery programmes and projects.

Moving on to the local sphere of government, where the actual impacts of climate change will be felt, many of the critical actions to manage climate variability and reduce climate change impacts, as identified in national policy, fall within local government responsibilities as detailed in the Constitution of South Africa (Act 108 of 1996) and the Municipal Systems (Act 32 of 2000). Local governments can also assist by creating enabling environments for the green economy to take root and in turn create opportunities for employment in sustainable infrastructure, sustainable agriculture, and sustainable energy sectors, whilst also empowering communities and businesses to become energy secure through development of policies, standards and tariffs that promote energy efficiency and renewable energy development.

Against this backdrop, the SALGA Local Government Energy Efficiency and Renewable Energy Strategy Guide (2021) guides municipalities on steps to take towards energy efficiency and renewable energy uptake in line with national policy direction and local governance mandates in response to the rapidly changing energy low carbon transition taking place and achieving national and climate mitigation and efficiency targets.

The SALGA Energy Summit Declaration (2018) also called for municipalities to be part of the solution and committed municipalities to:

- Support the Department of Mineral Resources and Energy in providing leadership to the sector to develop the necessary policy and legislative frameworks to embrace and accelerate the energy transition in South Africa;
- Change their processes, by-laws and tariffs to allow for decentralised generation (small scale embedded generation) in a manner that is safe and adequately covers the cost of using the electricity grid;
- Drive efficiency in municipal electricity operation and developing strategies to increase revenue collection;
- Work together and creating partnerships with customers, business, labour, civil society and investors to address the challenges in the

energy sector and to support municipalities to find sustainable ways to meet their social, economic and material needs;

- Provide and access the necessary capacity to ensure the required strategic direction and support to municipalities to scale up the transition;
- Promote and share existing and new innovative solutions towards more efficient, affordable and sustainable energy systems.

In addition, the growing importance of the green economy, as a lever to stimulate post-COVID-19 economic recovery, presents South African municipalities (particularly cities) with the opportunity to unleash their transformative potential, find their own innovative, decentralized solutions to meet their energy needs, and future proof their energy systems.

The adverse effects of not responding to climate change will not only get worse over time, but continue to destroy our natural habitat - with exorbitant infrastructure repair and replacement costs. Municipalities have important control and influence over building codes, land use planning, urban parks and conservation, water and electricity supply, waste management, transport, air quality management, and other relevant policy areas, as a result, hold more responsibility in ensuring that climate change is averted.

7.2. Adaptation and Mitigation responses

Emalahleni Local Municipality is not immune to climate change vulnerability and the capacity for adaptation and mitigation will rely strongly on the ability of the municipality's political and administrative executive to make decisions that will place the municipality at the best possible position to respond to climate change. Climate change mitigation and adaptation responses additionally require a whole of society response. As a result, the process of planning for climate response and the social acceptability and/or effectiveness of climate policies, requires strong engagements and the involvement of civil society, business and communities. It is therefore important to understand what the locally appropriate climate response/actions are for Emalahleni, considering its current status quo in relation to climate change.

7.2.1. Potential Adaptation Responses for Emalahleni

Adaptation actions are necessary to respond to those impacts of climate change which cannot be avoided. In general, the objective of any adaptation response is to reduce the vulnerability of communities, societies, businesses, and the economy to climate risks, and to build resilience to both present and future climate change. For Emalahleni, the adaptation priorities will largely align with national priorities across the following sectors:

- Water resource management
- Alternative agricultural practices and commercial forestry

- Environmental Health
- Biodiversity and ecosystems
- Human settlements (both urban and rural)
- Disaster risk management

A list of potential adaptation responses is provided in the Table below.

7.2.2. Potential Mitigation Responses for Emalahleni

Mitigation responses focus on systematically reducing vulnerabilities including reducing greenhouse gas emissions through initiatives such as energy efficiency and renewable energy use. Sector-specific mitigation actions are required as they are better suited to address sector-specific barriers, more specifically for sectors, notably energy, waste, transport, industry sectors, that are responsible for the larger share of the carbon emissions. Directorates within the municipality can realise many of the mitigation actions through including and integrating such actions in their existing (or revised) sector-based master plans, which inevitably are integrated into the municipal IDP.

For Emalahleni, the mitigation priorities will largely align with national priorities across the following sectors:

- Energy: in relation to energy demand management, alternative clean energy sources and energy efficiency
- Green economy (Local economic development)
- Human settlements (both urban and rural)
- Transport

A list of potential mitigation actions is provided in the Table below, presented on a sectoral basis.

7.3. Climate Action Response and the Just Transition

A socio-economic transition is under way both globally and in South Africa. It is a convergence of multiple factors. One of the core factors underpinning it, is climate change. The increased occurrence of physical impacts from climate change provides an alarming signal of the consequences of not responding to mitigating climate change. As a result, the strengthening of the global climate regime has led to intensified action and policy responses, with shifts in trade, finance and investment trends favoring a decarbonized global economy (IPCC 2018). Many of South Africa's trading partners have already adopted net-zero carbon targets and intend to lower their emissions and impose trade barriers on carbon emissions-intensive products.

The economy of South Africa has been built largely on cheap electricity generated from coal. South Africa is among the most carbon-intensive economies in the world, contributing more than one percent of global Greenhouse Gas (GHG) emissions

despite its proportionately smaller population and gross domestic product (GDP). The energy sector accounts for the majority of these emissions: Over 80 percent of the sector's emissions arise from coal fired electricity generation (coal fired plants generate 92 percent of the electricity) and the liquefaction of coal.

The coal mining sector alone to date accounts for about 75% of the total mass of all minerals produced nationally (StatsSA 2019) and the idea of transitioning away from such has posed threats not just to the existing coal mines, but to industries that have been largely dependent on the existence of coal fired electricity. Coal mining and electricity generation are concentrated in Mpumalanga, where 80% of the production of coal occurs. The eMalahleni (formerly Witbank) and Highveld coalfields account for 75% of coal production in South Africa. Emalahleni Local Municipality is among four municipalities in Mpumalanga that have highly undiversified economies, heavily reliant on coal mining – eMalahleni (Witbank), Steve Tshwete (Middelburg), Govan Mbeki and Msukaligwa (Ermelo). In eMalahleni, coal accounts for 44% of the economy (GVA) and mining accounts for 26%, of total employment. Miners in these four local municipalities account for approximately 76% of total coal employment in South Africa. It is evident that Emalahleni has a high proportion of GVA (Gross Value Added) derived from coal activity and a high number of individuals employed in the coal sector. The immediate impacts of a decline in coal production and/or coal-based electricity will be felt by the most vulnerable in the value chain. To this end municipalities such as eMalahleni will stand to be severely hit with rising unemployment and reduced economic activity as South Africa transitions to decarbonised economy (TIPS 2019).

As South Africa's trading partners pursue the goal of net-zero carbon emissions, they are likely to increase restrictions on the import of goods produced using carbon-intensive energy. Since much of our industry depends on coal-generated electricity, South Africa is likely to find that the products it exports to various countries face trade barriers and, in addition, consumers in those countries will be less willing to buy our products.

A further economic risk that South Africa faces is the avoidance of investors in investing in fossil fuel powered industries. Banks and financial institutions are currently facing pressures from their shareholders not to finance enterprises that depend on fossil fuels to produce their products or services.

All these emerging trends point to South Africa requiring to act with urgency and ambition to reduce national greenhouse gas emissions and undertake a transition to a low-carbon economy. However this transition would need to be just as there are several important sectors of our economy that will be negatively affected by such a transition, including agriculture, tourism, mining, energy, transport, manufacturing and the biodiversity economy (The Presidency RSA 2021).

A transition to a decarbonised economy in South Africa therefore requires addressing the needs of workers in these industries and in affected communities. The process of transition requires the full involvement of organised labour and business in targeted programmes of reskilling and upskilling, creating employment and providing other forms of support to ensure workers are the major beneficiaries of South Africa's shift to a greener future (The Presidency RSA 2021).

What is the 'Just Transition'?

'Just Transition' is a framework that has been developed by the trade union movement to encompass a range of social interventions needed to secure workers' jobs and livelihoods when economies are shifting to sustainable production, including avoiding climate change and protecting biodiversity, among other challenges.' It has been broadened beyond a focus on protecting the rights of the working class only but also encompasses wider society, especially the most vulnerable.' - National Planning Commission, (2019).

The framework for the Just Transition pathways in South Africa is derived from Chapter 5 of the National Development Plan, which explicitly states the commitment towards ensuring that South Africa is an environmentally sustainable society by 2030, with an expanded low-carbon economy and reduced emissions, coupled with reduced poverty, inequality, and unemployment (National Planning Commission 2019). The just transition approach encapsulates environmental sustainability from an economic, social, and political perspective and emphasizes the need for all three to be in balance to achieve climate change adaptation and mitigation. Key aspects of the just transition approach include:

- looking at the economy of the region and how it seeks to transition to one that is less carbon-intensive (low-carbon economy) through restructuring the society - by altering patterns of inequality, poverty, and vulnerability for communities,
- looking at whether development is sustainable and integrated, involves social progress, environmental protection, and economic prosperity, that there is efficient participation from the bottom-up of all stakeholders and a commitment from the government,
- the International Labour Organization (ILO) guidelines on just transition seek to balance out work and communities with the structural economy for a better and more inclusive economy, sustainability, and employment creation,
- the National Planning Commission (NPC) just transition pathway process has adopted a broad approach for the just transition to a low carbon (mitigation), climate-resilient (adaptation) economy and society that protects the rights of the most vulnerable (energy poverty) including women (gender mainstreaming), children and poor/working-class households broadly.

A Just Transition means leaving no-one behind. It requires procedural equity to lead to equitable outcomes. It is at the core of implementing climate action in South Africa, as detailed in both the mitigation and adaptation goals presented in the updated NDC 2021. South Africa's Just Transition plans include planning for workforce reskilling and job absorption, social protection and livelihood creation, incentivising new green sectors of the economy, diversifying coal dependent regional economies, and developing labour and social plans to prepare for the decommissioning of coal fire stations. Similar measures will be necessary to adapt to the impacts of climate change.

In strengthening its efforts to achieve South Africa's climate change commitments, national government recently approved the establishment of the Presidential Climate Change Coordinating Commission (P4C) to coordinate and oversee the Just Transition in South Africa. The P4C was created through the Climate Change Bill. Key among its tasks is to understand the both the positive and negative impacts of climate change on jobs, climate change responses by sector and location, and to ensure the implementation of climate change policies in the long-term. The President's approval of the P4C in December 2020 was supported by the significant role the P4C will play in advising government on pathways to transition to a low-carbon economy and climate-resilient society. One of the first tasks of the Presidential Climate Commission is to develop a framework for a just transition (Patel 2021). This framework will serve as a practical guide for all affected stakeholders in South Africa, ensuring that the transition to a low-emissions economy is well-managed, just, and equitable, with particular focus on the poorest and most vulnerable. The framework will build on the existing just transition debates in the country, as well as the vision set out by the National Planning Commission.

The province is also undertaking work to manage the just transition, particularly in view of the concentration of the coal value chain located in this province. This work is informed by the Department of Forestry Fisheries and Environment (DFFE) National Employment Vulnerability Assessment, and the Sector Jobs Resilience Plans and the Just Transition framework (currently underway with development). Province is under way with the Mpumalanga Climate Change Mitigation Strategy (MCCMS) led by the Mpumalanga Provincial Government's Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA). The time horizon for the implementation of the strategy is from 2019/20 until 2024/25. The strategy sets forth a vision to lead in creating an innovative, low-carbon and sustainable province. The strategy hinges on collaboration between Mpumalanga DARDLEA, Department of Public Works, Roads and Transport (DPWRT), Department of Education and Training, COGTA and Treasury, among others. Donor funding support relies on a mix of state, donor and private funding to realise the goals.

Mpumalanga Province has also engaged GreenCape to replicate the sector development agency/cluster model from the Western Cape in order to advance the sustainable and just transition in the province. This is known as the Green Economy

Cluster. GreenCape was initially created as an independent sector development agency. The model that is currently being adapted to Mpumalanga works through engagement at the convergence of government, business and academia – termed the triple helix nexus. The network of stakeholders has been identified as a robust instrument for the green and high-tech transitions. Mpumalanga is working with GreenCape to understand how the cluster approach can be adapted successfully to the province. This has resulted in a formal memorandum of understanding to collaborate on using a cluster approach to build a green economy in Mpumalanga (Patel, 2021).

To address the climate change risks related to the energy transition and the closure of coal-fired power stations, with support from the provincial government, municipalities will craft localised actionable responses, and align its development plans with the just transition objectives. The Just Transition in Mpumalanga, and by default in Emalahleni, is necessary to address unemployment, youth unemployment more especially and growing in-migration which have adverse economic and infrastructure provision effects in mining affected communities. Structural and institutional transformation is necessary to effect these changes (Burton 2020).

7.4. Just Transition in the Emalahleni Local Municipality context

Emalahleni Local Municipality located in the coal mining and power plant hub of the country, is subject to high levels of greenhouse gas emissions and harmful particulate matter pollution. The southern areas of the Emalahleni Municipality form part of the region referred to as the ‘*Energy Mecca of South Africa*’, due to its rich deposits of coal reserves and power stations such as Kendal, Matla, Duvha and Ga-Nala, with the Kusile power station located a few kilometres to the east of Phola. The southward road and rail network connects the Emalahleni area to the Richards Bay and Maputo harbours, offering export opportunities for local manufacturing and mining activities (Emalahleni Local Municipality 2017-2022).

Emalahleni is by default, central to the country’s Just transition objectives. As the site of some of the country’s major power stations and coal mining activities, the municipality is a key role player in the local, provincial, and national objectives of the Just Transition. The Just transition is aligned to the country’s commitments to reduce greenhouse gas emissions and to transition into a low-carbon economy with an emphasis on cleaner more sustainable energy sources. Coal mining accounts for 44% of the Emalahleni’s GVA (TIPS 2019), rendering the municipality a critical “hot spot” both environmentally and economically, given its heavy reliance on the coal sector. Emalahleni together with three other municipalities in the Mpumalanga Province that are heavily invested in the coal sector, face huge economic losses related to the decommissioning of coal mines as part of South Africa’s response to climate change.

These municipalities require employment-mitigation plans and research undertaken in analysing their vulnerabilities in addition to those of miners themselves, as well as the alternative economic opportunities available and the extent to which they can be exploited.

At the municipal level, a Just Transition approach would involve implementing development plans across all sectors of the economy in an integrated manner that promotes a balance of resources across the board. This should look at the functionality of the economy with regards to the availability of jobs and the growth of the local economic development (LED), creating socially viable and livable spaces with affordable infrastructure, reducing carbon emissions and committing to a low carbon environment (climate change mitigation), ensuring that there is clean, affordable and sustainable energy provision and lastly, as the main provider of local infrastructure, ensuring that there is clean sustainable water, a decarbonized transport system, integrated decarbonized human settlements and equity in planning for land use. In particular to the coal mining towns in Nkangala District, Just Transition needs to consider how existing industries can support emerging green energy markets – the manufacturing sector (steel production), to rethink municipal revenues – protecting and incorporating revenues from new energy generation and consumption activities, job creation opportunities through municipal investments, undertake robust risk-sensitive planning and addressing current and new energy needs within the context of energy poverty and access (Just Urban Transitions 2021).

To this end, Emalahleni municipality is already underway with addressing some of these areas. For instance, the municipality has scaled up the rolling out of solar photovoltaic Small Scale Embedded Generation (SSEG) systems in its locality and currently has about 5 SSEG systems with approximately 2MWp total capacity (SALGA 2020). The municipality, through its Local Economic Development Master Plan, has an opportunity to plan for the transition into green jobs, which will be necessitated by the decommissioning of the coal mines. This concurrently involves creating opportunities in the green economy for women, the youth, small businesses, and farmers.

7.5. Climate Change Cross-cutting Responses

As a cross-cutting phenomenon, climate change response also requires the inclusive participation of all society stakeholders. Apart from physical damage of infrastructure, climate change impacts the livelihoods of all. Extended dry seasons, increasing temperatures, extreme storms result in drought, crop failure, livestock death – which will further entrench poverty with the increase of vector-borne disease, disabling existing livelihoods and damage to household assets. These are but a few challenges that are cross-cutting. Of great importance is the impact to the local economy. A changing climate impacts existing and future business prospects for small business owners, industries, and commercial sectors. The following bullet points refer to a suite

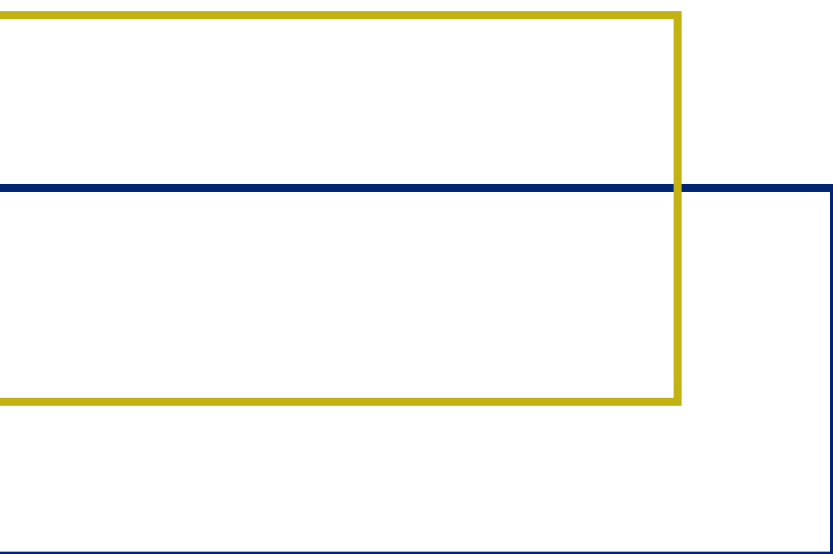
of actions and measures that the municipality needs to focus on to facilitate the additional climate change responses in Emalahleni LM:

- Communications
- Research and technological innovation
- Policy and legislative frameworks
- Institutional arrangements
- Climate finance

Gender considerations

Gender as a dimension of climate change is relatively new. The confluence of gender and climate change has in recent years been a crucial discussion point in the international climate change discourse. Researchers and practitioners have demonstrated the inter-relationship between climate change and gender, since climate change tends to exacerbate existing gender inequalities, with women facing disproportionately more negative impacts than men. Moreover, women are important agents of change – recognizing the contributions of women as decision makers, stakeholders, educators, careers, and experts across sectors and at all levels can lead to successful, long-term solutions to climate change. Women have the knowledge and understanding of what is needed to adapt to changing environmental conditions and to come up with practical solutions. However, they remain a largely untapped resource. Restricted land rights, lack of access to financial resources, training and technology, and limited access to political decision-making spheres often prevent women from playing a full role in tackling climate change and other environmental challenges. Women have proven to be forging the path towards more equitable and sustainable solutions to climate change. Across sectors (both at the household and national level), women’s innovations and expertise have transformed lives and livelihoods, and increased climate resilience and overall well-being. It is important to ensure equal space and resources for women and men to participate in climate change decision making and action at all levels. Climate finance should be accessible to both men and women and developed to derive mutual benefits and not exacerbate patterns of inequity.

Several tools have been developed, enabling climate change risks and vulnerabilities to determine the differentiated impacts of climate change on men and women. The National Climate Change Adaptation Strategy recognizes this vulnerability and calls for the consideration of gender inclusivity in the design of climate programmes, projects, and interventions



Strategic Response Action Plan



7.6. Strategic Response Action Plan

7.6.1. Strategic Focus Area: Governance

To develop an efficient and climate-responsive municipality

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
<i>Mainstream and lead climate change response through municipal policy programmes, strategies, processes, plans, projects and by-laws in the municipality</i>	Climate change response integrated into all municipal Sector Departments/Directorates	<ul style="list-style-type: none"> Establish a Climate Change Steering committee from a cross-sector of relevant departments to address the climate issues and improve cross-sector integration of management and development planning. Mitigation and adaptation efforts fall under the responsibility of a range of departments, so institutional coordination is important. Appoint a Climate Change coordinator (review the municipal organogram) and designate champions from all directorates to drive the climate change planning process. Coordinate and oversee the implementation of climate change projects, policy programmes, strategies, processes, plans, and by-laws programmes and research activities in the municipality. 	Municipal Manager's office and Mayor's office	All Directorates	2021/22 FY – 2024/25 FY
<i>Transit to lower carbon economy and</i>	Build climate-resilient communities and strive to reduce emissions from	<ul style="list-style-type: none"> Develop a Vulnerability and Risk Assessment Study for the municipality 	Mayor's Office (Ward councillors)	All Directorates	2021/22 FY – 2026/27 FY

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
<i>build a climate-resilient society</i>	an environmental and socio-economic perspective socio-economic perspective	<ul style="list-style-type: none"> • Develop a GHG emissions Inventory for the municipality • Develop a Just Transition Plan for the municipality that transforms the municipal economy into one that is sustainable and inclusive for all • Implement a Climate Change Response Action Plan to ensure climate change response activities are integrated into sector strategies and plans. The Action Plan will specify projects, responsibilities, timeframes and targets for a 5-year period and should be approved by Council and reviewed every 5 years. Projects need to be reflected in the Service Delivery Budget Implementation Plan (SDBIP) and associated municipal budget. Once projects are included in the SDBIPs, the targets and indicators set in the Climate Change Action Plan will be reflected in the performance management of all key staff (through KPIs). 	Municipal Manager's office		
<i>Ensure periodic, reporting, ongoing monitoring and evaluation, review and update of all municipal policy programmes, plans,</i>	Develop and implement an M&E system that tracks the implementation of climate change actions and their effectiveness	<ul style="list-style-type: none"> • Develop and implement a monitoring and evaluation mechanism/system for climate change actions such as key performance indicators (KPIs) which form part of the municipality's performance management system to track progress towards meeting climate objectives. 	Mayor's Office Municipal Manager's Office	All Directorates	2021/22 FY – 2026/27 FY

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
<i>projects, processes and strategies and by-laws responding to climate change</i>		<ul style="list-style-type: none"> Report to all sectors and the public on progress towards meeting the municipal indicators outlined in this implementation plan. Compliance with reporting requirements of National Climate Change Information System by collaborating with stakeholders 			
<i>Build climate change response capacity through institutional strengthening (human resources, strategic leadership, intergovernmental relations, powers and functions, financial systems), technology transfer, resource mobilization, partnership building and stakeholder involvement.</i>	Enhance climate change capacity building and resource mobilization for implementation of climate change response actions	<ul style="list-style-type: none"> Promote education, awareness-raising, training, information dissemination, knowledge management and social empowerment on climate change for all stakeholders Collaborate and support research on climate change aspects concerning other stakeholders. Develop a climate response communication plan and encourage local voluntary commitment to respond to climate change. Develop procedural elements for social dialogues and democratic governance to involve citizens in decision making and choices about their future, to reduce the vulnerability to climate change and transitioning to lower carbon development. 	Mayor's Office Municipal Manager's Office	All Directorates	2021/22 FY – 2026/27 FY

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
Secure dedicated funding for implementation of Climate Change Strategy	Ensure financing for climate responsive projects, programmes, processes, strategies, plans and policies ¹¹	<ul style="list-style-type: none"> Mobilize funding for climate change implementation through internal and multilateral funding mechanisms. Ensure that climate change actions are reflected in the SDBIP. Explore opportunities of external funding with international funders for climate action. Expand funding streams particularly for pilot projects or priority projects – ‘Seeing is believing’ and showcasing projects generates momentum to attract funding and building council support. 	Mayor’s Office Municipal Manager’s Office	All Directorates	2021/22 FY – 2026/27 FY

7.6.2. Strategic Focus Area: Environment

To develop an adaptive and climate-responsive municipal environment

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
Improve Air Quality management in the municipality	Implement Air Quality management plan	<ul style="list-style-type: none"> Review and monitor the enforcement of the Air Quality management by-laws to integrate climate change considerations 	Environmental & Waste Management Directorate	Municipal Manager’s Office	2021/22 FY – 2026/27 FY

¹¹ For more detailed and very helpful guidance on unlocking municipal climate finance to fund local climate action please refer to: “A practical systematic guide towards unlocking municipal climate finance” produced by the Department of Environment, Forestry and Fisheries (DEFF) (2019). Available at: https://africa.iclei.org/wp-content/uploads/2020/04/2019_Publication_Municipal-climate-finance.pdf

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
		<p>such as including the monitoring of GHG emissions. This serves as an important lever for the municipality to encourage energy efficiency in local industry and lower carbon development.</p> <ul style="list-style-type: none"> • Review Air Emission inventory to identify the source of air pollution. • Implement the Vehicle emission control and testing strategy. • Install ambient air quality monitoring stations. • Proactively reduce fire risk and the impact of fires on communities and natural areas. 		Community Services	
Improve waste management processes to reduce GHG emissions	Ensure effective implementation of the Waste management hierarchy	<ul style="list-style-type: none"> • Implement the waste minimization and reduction strategies as per the Integrated Waste Management Plan(IWMP) and the national waste management strategy • Implementation of waste-to-energy technologies • Establish recycling initiatives to reduce GHG emissions • Reduce organic waste disposal to landfills by 40% by 2030 and 100% by 2050 	Environmental & Waste Management Directorate	<p>Municipal Manager's Office</p> <p>All Directorates</p>	2021/22 FY – 2026/27 FY

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
		<p>through improved waste management systems</p> <ul style="list-style-type: none"> Divert recyclables from the landfill site by 50% by 2030 through promotion cooperatives and SMMEs 			
Enhance the use of the ecological infrastructure and biodiversity conservation to create resilience against extreme weather patterns	Integrate climate change adaptation across vulnerable areas in the municipality through biodiversity conservation and safeguarding of ecological infrastructure	<ul style="list-style-type: none"> Develop and implement an Eradication of Alien Invasive Species Plan Revise disaster management plan to respond to climatic challenges (such as floods and fires) and establish early warning systems Develop the bioregional plan and ensure the expansion of the protected areas network and further implement the Ecosystem-based Adaptation plan (EbA). Replenishing natural resources base through rebuilding wetlands, planting trees, clearing alien vegetation creates jobs and enhances important environmental services such as water, flood protection, fish and plant stocks. Establishment of botanical gardens and nurseries. Revitalize the Witbank nature reserve (including the Environment Center) 	<p>Municipal Manager's Office</p> <p>Environmental & Waste Management Directorate</p>	All Directorates	2021/22 FY – 2026/27 FY

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
		<ul style="list-style-type: none"> Reduce flood risk and storm damage through the implementation of the Water Service Plans or Water Master Plan and the disaster mitigation approaches which considered climate change elements. 			
Build climate capacity and awareness within the municipality and communities	Integrate climate change capacity development into staff capacity programmes and further introduce climate awareness among communities	<ul style="list-style-type: none"> Capacitate officials and political leadership on climate action. Raise awareness among communities and citizens using various media platforms (e.g. web based tools, campaigns that provide citizens with reliable information to make informed decisions; forum for information exchange amongst business and industry; and programmes of action for behavior change) to influence citizen action or behavior towards positive climate response outcomes 	<p>Environmental & Waste Management Directorate</p> <p>Collaborate with SALGA for support on climate change training in relation to political leadership and municipal officials</p>	<p>Municipal Manager's Office office,</p> <p>Mayor's office</p> <p>Community Services</p>	2021/22 FY – 2026/27 FY

7.6.3. Strategic Focus Area: Infrastructure

To develop low-carbon and climate-sensitive infrastructure and built an environment

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
Reduce GHG emissions in Electricity and Energy; Human Settlements and Transport Sectors	Develop a renewable energy (RE) and energy	<ul style="list-style-type: none"> Implement a RE/EE strategy action plan All existing residential and commercial buildings to be retrofitted with energy-efficient technologies to be net-zero carbon in operation by 2030 	<p>Technical Services (Electricity) Directorate and</p> <p>Development Planning Directorate (Building</p>	Environmental & Waste Management	2021/22 FY – 2026/27 FY

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
	efficiency (EE) strategy for the municipality ¹²		Control, Transport and Human Settlements)		
	Develop low carbon-built environment that can improve the quality of life and stimulate economic growth in Emalahleni	<ul style="list-style-type: none"> • Develop a Green Buildings Strategy for the municipality. • Develop and implement a green buildings policy and by-laws • Encourage communities to participate in green building initiatives and climate-resilient activities • Raise awareness of builders, architects and developers around new regulations and best practice • Commit to all new buildings (residential, commercial, and municipal) to be net-zero carbon by 2050. • All existing municipal buildings to be net-zero carbon by 2030 • Alter any zoning of new housing projects in areas at risk of flooding to avoid future flood damage 	Technical Services (Electricity)	Environmental & Waste Management Development Planning Directorate (Human Settlements and Building control)	2021/22 FY – 2026/27 FY

¹² Refer to the SALGA Local Government Energy Efficiency and Renewable Energy Strategy Guide which provides a clear programme of action for local government to promote energy efficiency and renewable energy development in line with national policy direction and within local governance mandates. Available at: <https://www.cityenergy.org.za/salga-local-government-energy-efficiency-renewable-energy-strategy-guide/>

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
	Integrate green transport principles into municipal Integrated Transport Plan including non-motorized transport	<ul style="list-style-type: none"> Develop an Integrated Green Transport Plan which addresses establishing an efficient public transport system that is fast, frequent, reliable, safe and accessible and moving to cleaner alternatives to current transport fuels as well as encourages compact city planning which reduces the need for multiple and long trips. Build infrastructure suitable for rolling out of electric vehicles to minimise the economic cost of energy through maximising energy efficiency opportunities Take a lead in the introduction of electric vehicles by gradually introducing them through the municipal fleet system Implement non-motorized transportation approaches that maximize the use of bicycle and pedestrian transport. Alternative mass transit infrastructure should be introduced at strategic routes to minimise GHG emissions. Public transport reduces pollution and congestion and improved mobility of people stimulates economic activity. Road maintenance and storm water drainage maintenance and upgrade plans to cope with increased volumes and storm damage. 	Technical Services (Roads and Storm Water)	Environmental & Waste Management Community Services Directorate Development Planning Directorate	2021/22 FY – 2026/27 FY

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
Build climate-resilient infrastructure within the municipality	Ensure climate-resilient materials and methods are utilized in infrastructure development	<ul style="list-style-type: none"> • Incorporate climate proofing in the planning and design of all municipal infrastructure. • Introduce cycling lanes. • Modify urban and peri-urban settlements to reduce risks and vulnerability to be capable to recover from extreme weather patterns. • Construction of Water Recycling Facility 	Technical Services	All Directorates	2021/22 FY – 2026/27 FY

7.6.4. Strategic Focus Area: Economy

To develop an efficient, sustainable, and climate-responsive local economy

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
Build sustainable climate-sensitive agricultural practices	Develop a sustainable climate-sensitive Agricultural Development Plan for the municipality	<ul style="list-style-type: none"> • Implement sustainable climate-smart agriculture that considers short term short-term adaptation strategies in response to a decrease in rainfall could include over-exploitation of groundwater resources, which could actually exacerbate vulnerability over the longer term; innovative approaches, new technologies and monitoring of the effectiveness of strategies in light of changing circumstances is necessary to make sure that coping and adaptation 	Local Economic Development	Technical Services (Electricity)	2021/22 FY – 2026/27 FY

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
		<p>strategies remain appropriate; the use of more intensive farming or diversification of crop production as a result of soil erosion (increasing irrigation/fertilizers); changes in crop types or switching to dry land farming.</p> <ul style="list-style-type: none"> • Create an enabling environment for agro-processing to thrive within the municipality. • Promote food security, as well as low carbon and climate-resilient food systems in Emalahleni. 			
Promote a circular and green local economy	Ensure local economy integrates renewable energy and energy efficiency opportunities	<ul style="list-style-type: none"> • Review the current LED strategy to include and integrate green economy projects (such as efficient public lighting programme, renewable energy development and value-add processing to local agriculture) and considers the vulnerable sectors that require resources for adaptation • Investigate sources of climate finance and the use of innovative financial mechanisms to support climate change response and implement where feasible • Continuously review and improve business models and practices to respond effectively to the impacts of 	Local Economic Development	All Directorates	2021/22 FY – 2026/27 FY

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
		<p>climate change and the threats and opportunities arising from new technologies</p> <ul style="list-style-type: none"> Proactively work to reduce the economic impact of climate change on key economic sectors 			
Promote ecotourism and green jobs	To position ELM as a green and tourism hub, underpinned by local skills and IKS	<ul style="list-style-type: none"> Review the Local Tourism Plan to include all the climate change opportunities and that considers the: promotion of biodiversity/nature-based tourism; compliance with energy, waste and water efficiency measures; partnering with relevant organisations such as Worldwide Fund for Nature (WWF) (sectors such as tourism may be focused on as 'lead' sectors); special events to promote environmental profiles of the municipality, for example incorporating zero waste, green electricity, efficiency, and recycling; and implementing visual renewable energy systems at key locations Promote diversification and greening of the local tourism industry. Support the development of local green industries Explore the possibility of developing the Waste processing plant 	Local Economic Development	All Directorates	2021/22 FY – 2026/27 FY

7.6.5. Strategic Focus Area: Social

To develop safe, resilient, and climate-proof communities

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
To afford the community of Emalahleni a seamless and just transition to a low carbon economy without jeopardizing their socio-economic livelihoods	Promote diversification of economic activities to include sustainable green economic activities through partnerships and collaboration	<ul style="list-style-type: none"> • Ensure equitable access to essential services for low-income residents. • Development of quality low income housing stock. • Disaster risk reduction in informal and vulnerable settlements. • Supply chains reliant on climate sensitive areas may have to be diversified. • Sharing experiences and lessons learned: Communities are an important repository of experiences and lessons learned. These must be drawn upon to inform future actions – and policies that support actions. 	Technical Services Directorate Local Economic Development	All Directorates	2021/22 FY – 2026/27 FY
Identify climate change vulnerabilities within communities and establish measures to build resilience	To create a clean, healthy, and safe sustainable environment for the community	<ul style="list-style-type: none"> • Reduce immediate health risks related to extreme weather events exacerbated by climate change through ensuring the Heath Plan considers: improved sanitation to curb disease; increased awareness on/ preparedness for climate related health threats (vector-borne diseases, heat, air pollution, floods); pollution warning system; interventions to reduce air pollution; increase staffing and supplies (capacity support) for health facilities 	Community Services		

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
		<p>and nutrition programmes where climate impacts affect livelihoods and food security</p> <ul style="list-style-type: none"> • A heat alert system warning of heat stress impacting the young and elderly • Proactively reduce heat impacts on the city through urban greening 			

7.6.6. Strategic Focus Area: Spatial planning

To build a safe, resilient, and climate-proof institution

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
Ensure planning that is climate action orientated	Integrate climate Change into Municipal IDP and SDF	<p>The SDF should consider the following climate change impacts on these:</p> <ul style="list-style-type: none"> - zones (hectares) of sensitive, vulnerable, highly dynamic and stressed ecosystems in the municipal area – by ecosystem type (e.g. wetland, dunes etc.) - Identification of neighbourhoods that are vulnerable to climate change - Desertification, soil loss, soil acidification or salinization - Ecologically sensitive areas: habitats of endangered species, tidal wetland areas - Drought vulnerable areas - Flood risk areas - Impact of deforestation and the land use changes that may result from climate change 	Spatial Planning	All directorates	

Goal	Objective	Activity	Lead directorate	Stakeholders	Timeframe
		<ul style="list-style-type: none"> The SDF should consider the promotion of higher-density and mixed-use forms of development. The municipality can encourage the growth of livable, accessible communities. “Smart growth” planning—a strategy that highlights high-density, mixed-use, transit-oriented development— also has other goals, such as maintaining open space, farmlands, and other natural areas and directing municipal resources toward existing communities rather than diverting them to new development in outlying areas. 			

8. EMALAHLENI LM'S COMMITMENT TO CLIMATE RESPONSE

8.1. Climate Change Related Challenges

8.2. Commitments to Addressing Climate
Change

8.3. Financial mechanisms for Climate Change
Response



8.1. Climate change related challenges

Emalahleni has already been experiencing the impacts of climate change. Floods from heavy rains following extended periods of drought, resulted in serious damage to public infrastructure, with residential areas and informal settlements being the most impacted. The municipality over the years has attempted to develop a localised climate response plan to coordinate its efforts in responding to the impacts of climate change. With the development of this climate strategy, the municipality is now equipped with a clear climate change response framework that provides the strategic direction and blueprint for municipal climate change response.

In the past, in the absence of a municipal climate change strategy and the necessary institutional arrangements in place to coordinate climate response efforts, the municipality remained heavily reliant on external support from various government sector departments, to assist and coordinate efforts during times of climate invoked disaster. The municipality relies on the support of the District and the Provincial Disaster Management Centre for the provision of relief materials and capacity to mitigate disaster. The Department of Human Settlements also supported with repairing damaged afflicted to homes. Households whose property had flooded were provided with relief material to construct temporary structures with the support and assistance from Nkangala District Municipality. Local farmers also lost significant crop harvests.

8.2. Commitments to addressing climate change

The municipal leadership is cognisant of the current and projected population growth in Emalahleni and the real challenges it experiences in the planning processes to better coordinate its actions for more effective climate response. Emalahleni municipality has developed sector plans and implemented various programmes and projects that were not specifically targeting climate response but due to their nature, have responded to the impacts of climate change to a certain degree. A disaster management master plan has also been recently developed, which will improve the way in which the municipality has responded to disasters, and likely will include climate specific responses in relation to the vulnerability and hazards identified.

With this Climate Change Strategy providing the strategic direction, the municipality intends to integrate climate response directly into its planning headquarters – the Integrated Development Plan.

In turn the intention is to ensure climate response will be integrated into the various municipal sector plans. Once the plans have been approved and linked to the IDP, it will be important to develop further project detail and include this in the Service Delivery Budget Implementation Plan (SDBIP) as part of the municipality strategic planning process.

Emalahleni as one of the municipalities in Mpumalanga, whose economy is heavily reliant on the coal sector and in view of the low carbon transition underway, the municipality is aware of the need to diversify its local economy, by opening alternate economic activities in other sectors such as tourism and agriculture as well renewable energy development. The municipality in partnership with key stakeholders and private sector through its Local Economic Development strategy plan, seeks to promote local and foreign direct investment, increase its skill base and stimulate local economic growth leading to the creation of much needed jobs on a wider scale.

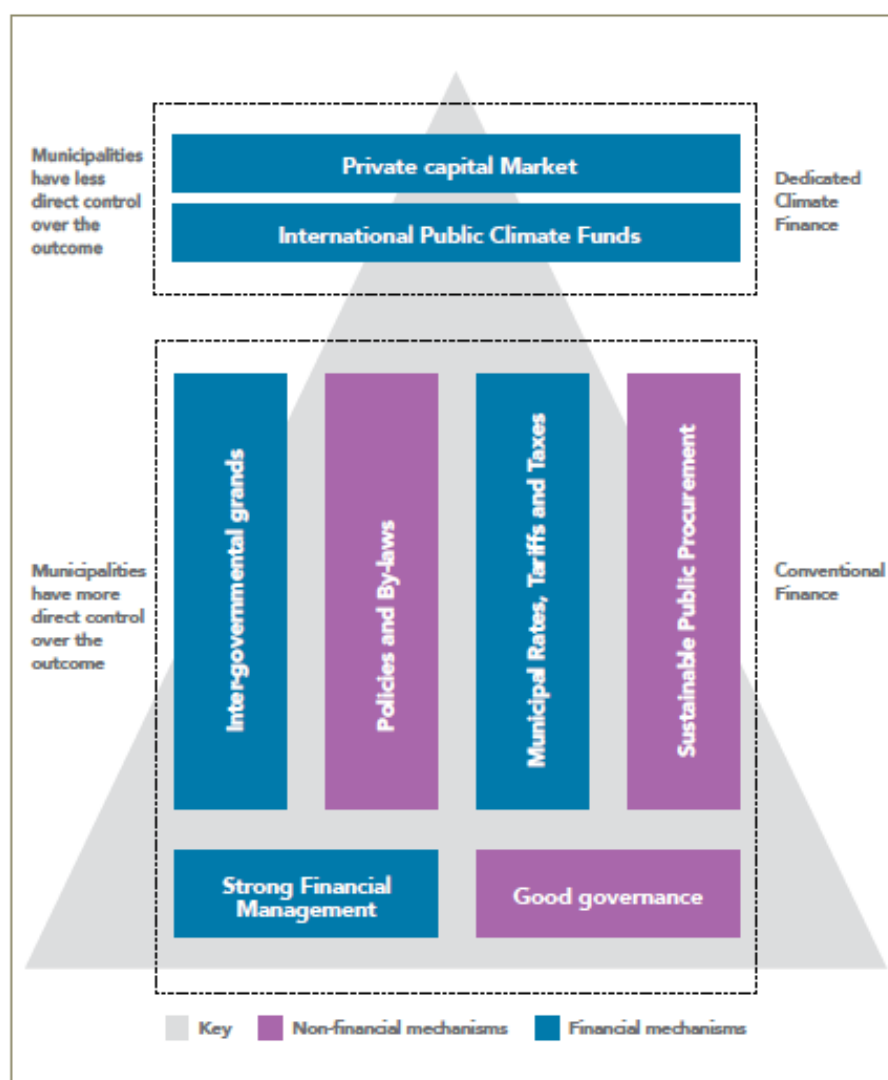
The municipality for instance could develop its IDP in combination with economic development specialists to develop projects that may diversify its economy away from coal and set up alternate employment opportunities for the populace in general but also to potentially absorb redundant coal miners should these miners become unemployed. Such a process would involve a number of specialists that are able to assess the existing infrastructure, examine the skills set of the existing labour force, and identify growth markets in which entrepreneurs can invest (TIPS, 2019).

8.3. Financial mechanisms for climate change response

The South African fiscal system relies on a broad tax base at the national level that constitutes the national budget and a more limited revenue raising power at the provincial and local levels. This leaves municipalities with two main sources of revenue—their own generated revenue and inter-governmental transfers which stem from national budget allocations as submitted annually to the National Treasury — additionally, a number of other additional sources that are project-specific or otherwise sporadic are also available. Own-revenue sources include service charges, fees and taxes (such as property taxes). Sources of smaller income also include rents, licencing and permits and traffic fines among other municipal charges.

This funding mechanism leaves funding options for local climate action in South Africa with a mix of domestic, bilateral and multilateral funding streams. There are few domestic sources of finance specifically earmarked for climate mitigation and adaptation objectives, meaning that municipalities must integrate climate action into their annual budgets and request intergovernmental grants in order to access predictable sources of finance. Multi- and bilateral funds are sourced for funding for climate change response actions, depending on the agenda of the fund or donor. Figure 12 below summarises the different mechanisms available to municipalities to fund climate action. Please also see Section 9 for more detail on ways to fund local climate action.

Figure 11: The Different Mechanisms available to Municipalities to Fund Climate Action



Source: (DFFE 2019)


In South Africa, climate finance is accessed primarily from five sources (DFFE 2019)

- Green Climate Fund (GCF)
- Global Environment Facility (GEF)
- Adaptation Fund
- Multilateral donors i.e., other national or regional governments such as Germany, the United Kingdom, the United States of America, the European Union, etc.
- South African National Government: Green Fund

These funds are provided in the form of large sums of money, such as billions of Rands. However, very few municipal projects are large enough to be eligible for such funding magnitudes. These funds therefore distribute the money to intermediaries in different sectors and countries for disbursement in smaller allocations according to their mandates. These intermediaries can be agencies or development finance

institutions. In South Africa, the National Department of Forestry, Fisheries, and the Environment (DFFE) is the primary national intermediary but has delegated this mandate to the Development Bank of Southern Africa (DBSA) and the South African National Biodiversity Institute (SANBI). Intermediaries often develop sector related funding programmes such as waste management, embedded generation, or ecosystem-based adaptation sectors, to name a few, in line with their mandate. They then release ‘Calls for Proposals’ from project implementers who will be the beneficiaries of these funds. Municipalities can apply to access these climate funds, through the national or international intermediaries that have the mandate to disburse funds for the sector in which the climate action is positioned. Municipalities may require intensive technical support from institutions to develop proposals to submit to intermediaries (DFFE 2019).

For more detailed and very helpful guidance on unlocking municipal climate finance to fund local climate action please refer to: “*A practical systematic guide towards unlocking municipal climate finance*” produced by the Department of Environment, Forestry and Fisheries (DFFE 2019). This manual provides a step-by-step guide on developing project proposals to respond to climate change mitigation, adaptation, and the green economy and how to access climate finance for such from various funding sources both domestically and internationally: Available at: https://africa.iclei.org/wp-content/uploads/2020/04/2019_Publication_Municipal-climate-finance.pdf



9. CLIMATE CHANGE RESPONSE HELPFUL RESOURCES AND SUPPORTING DOCUMENTS

- 9.1. Climate Change Response Updates
- 9.2. Climate change adaptation action for municipalities
- 9.3. (GHG) Inventory Development Resources
- 9.4. Climate Finance
- 9.5. Net Zero Carbon Buildings
- 9.6. Green Economy and Just Transition
- 9.7. Energy
- 9.8. Gender Considerations
- 9.9. Data

9. Climate Change Response – helpful resources and support documents

This section provides links to valuable resources and information that will help inform, and guide implementation of climate change action in the Municipality.

9.1. Climate change response updates

The latest scientifically robust information on climate change can be drawn from the:

- Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) (2014). This report provides an update on the state of knowledge in climate science since the IPCC Fourth Assessment Report (AR4) in 2007.
- IPCC 6th Assessment Report: Summary for Policymakers (2021). The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change

A more recent report was published in 2018 on the impacts of global warming of 1.5°C above pre-industrial levels. The report has demonstrated that an urgent global response is needed to limit warming. It urges that, to be consistent with 1.5°C by 2030, global CO₂ emissions would need to be 45% lower than those of 2010, reaching global net zero around 2050. The summary for policymakers synthesizes the key takeaways: <https://www.ipcc.ch/sr15/>

Links to helpful resources and support documents:

- **IPCC 5th Assessment Report:**
<https://www.ipcc.ch/assessment-report/ar5/>.
- **IPCC 5th Assessment Report - Synthesis Report Summary for Policymakers** - The key messages can be found in this report:
https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf

IPCC 6th Assessment Report: Summary for Policymakers (2021). The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change – available at:
https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf

9.2. Climate change adaptation action for municipalities

- **The Green Book** co-developed by the CSIR, and key partners is an online planning support tool that provides quantitative scientific evidence on the likely impacts of climate change and urbanization on South Africa's cities and

towns and presents several adaptation actions that can be implemented by local government to support climate resilient development.
<https://www.greenbook.co.za/>

- **Let's Respond Guide to Integrating Climate Change Risks and Opportunities into Municipal Planning** - A step-by-step guide to integrating climate change risks and opportunities into municipal Integrated Development Plans (developed by Sustainable Energy Africa and the Palmer Development Group for the Department of Environmental Affairs and Department of Cooperative Governance, and SALGA 2012).
<https://www.cityenergy.org.za/lets-respond-a-guide-to-integrating-climate-change-risks-and-opportunities-into-municipal-planning/>
- **Let's Respond Toolkit to Integrating Climate Change Risks and Opportunities into Municipal Planning** – This toolkit comprising of very helpful tools for climate response, complements the Let's Respond Guide (Developed by Sustainable Energy Africa and Palmer Development Group for Department of Environmental Affairs, Department of Cooperative Governance and SALGA, 2012).
<https://www.cityenergy.org.za/lets-respond-a-toolkit-to-integrating-climate-change-risks-and-opportunities-into-municipal-planning/>

9.3. Greenhouse Gas (GHG) emissions inventory development resources

- **Let's Respond Toolkit to Integrating Climate Change Risks and Opportunities into Municipal Planning** (Tools 8 and 9) – This toolkit comprising of very helpful tools for climate response, complements the Let's Respond Guide (Developed by Sustainable Energy Africa and Palmer Development Group for Department of Environmental Affairs, Department of Cooperative Governance and SALGA, 2012).
<https://www.cityenergy.org.za/lets-respond-a-toolkit-to-integrating-climate-change-risks-and-opportunities-into-municipal-planning/>
- **Measuring Greenhouse Gas Emissions for municipalities**
A city-wide GHG inventory enables municipalities to measure their overall emissions, as well as understand the contribution of different activities within the city. The Global Protocol for Community-scale Greenhouse Gas Emission Inventories (also referred to as GPC) is a GHG Protocol standard developed by C40, World Resources Institute and ICLEI - Local Governments for Sustainability. The GPC provides a robust framework for accounting and reporting city-wide GHG emissions.
<https://ghgprotocol.org/> and
<https://resourcecentre.c40.org/resources/measuring-ghg-emissions>
- **Guide to Energy and Emissions Data Collection for South African Municipalities**
This document provides municipalities with a detailed methodology on how to conduct data collation data for a Greenhouse Gas Inventory (SEA, 2017).

<https://www.cityenergy.org.za/guide-to-energy-and-emissions-data-collection-for-south-african-municipalities/>

- **Steve Tshwete Greenhouse Gas Inventory 2019**
The Steve Tshwete Greenhouse Gas Inventory is compliant with the international accounting protocols, techniques, and methodologies of both the International Local Government Greenhouse Gas Emissions Analysis Protocol and the Global Protocol for Community-Scale Greenhouse Gas Emissions (ICLEI for Steve Tshwete Local Municipality, 2019).
- **The Municipal Energy Efficiency Planning Tool** - An Excel spreadsheet tool that provides a simple analysis of energy savings impacts, capital costs, payback times and emissions savings from the implementation of established efficiency interventions within municipal operations (street and traffic lighting, vehicle fleet, wastewater treatment and bulk water, etc.) (SEA and SACN, 2015).
<https://www.cityenergy.org.za/energy-efficiency-planning-for-local-government-spreadsheet-tool/>

Local electricity emissions factor calculator (SEA, 2021) - This is a very helpful tool developed by Sustainable Energy Africa that allows a municipality to calculate a local electricity emissions factor, based on sources of electricity, including Eskom (including Eskom power plants and electricity bought by Eskom from IPPs and imports), IPPs (direct purchase by the municipality), own-generation (by the municipality) and small-scale embedded generation (SSEG) – assumed rooftop PV.
<https://www.cityenergy.org.za/local-electricity-emissions-factor-calculator/>

9.4. Climate finance

- **A Practical Guide Towards Unlocking Municipal Climate Finance (DFFE 2020)** - A step-by-step guide to support municipalities with preparing projects to leverage climate finances and accessing different funding and financing schemes.
https://africa.iclei.org/wp-content/uploads/2020/04/2019_Publication_Municipal-climate-finance.pdf
- **Multi-Level Climate Governance in South Africa - Catalyzing Finance for Local Climate Action** - This report focuses on the multi-level institutional arrangements that enable or hinder the funding of effective climate action at the local government level in South Africa.
<https://www.cityenergy.org.za/multi-level-climate-governance-in-south-africa-catalysing-finance-for-local-climate-action/>

9.5. Net zero carbon buildings

- **The Smart Buildings digital portal** – provides tools and vital information for municipalities on how to transform the way we design and engineer cities through smart laws and policies as well as participation and commitment from all community partners. This Smart Buildings hub is where you'll find the tools and information you need to play your part – whether you're a building

professional, a city official or an engaged citizen. It can be accessed at:
<https://smartbuildings.org.za/>

- **A Guide to Developing Net Zero Carbon Buildings in South Africa**
This guide is an overview of the concept of net zero carbon buildings in South Africa and gives guidance and references to approaching a net zero project. The focus is on new and existing commercial buildings, mainly offices, with some reference to the residential sector.
<https://smartbuildings.org.za/wp-content/uploads/2021/02/getting-to-zero-1.pdf>
- **The South African Buildings Programme** - This document shares the experiences of the four South African cities that are part of the South African Buildings Programme.
<https://smartbuildings.org.za/wp-content/uploads/2021/05/The-South-African-Buildings-Programme-V16.pdf>
- **Cost Model Comparing ‘Green’ and Standard Buildings** – This Excel-based model provides capital (construction and PV) and electricity costs for different building types (residential, office, retail and school) for standard buildings, energy efficient buildings and energy efficient buildings with rooftop PV. Various inputs can be adjusted to test the financial case for green buildings (SEA, 2021).
<https://www.cityenergy.org.za/cost-model-comparing-green-and-standard-buildings/>
- **New Building Emissions Model** – This model calculates electricity consumption and electricity-related emissions from buildings in the residential and commercial sectors for different policy scenarios (business as usual, SANS and local by-laws), based on information entered in the Inputs sheet (SEA, 2019).
<https://www.cityenergy.org.za/new-building-emissions-model/>

9.6. Green Economy and Just Transition

- **The Just Transitions Knowledge Portal** – created by TIPS (Trade and Industry Policy Strategies Research Institute) provides access to a growing body of work on the Just transition in South Africa. TIPS recognizes that establishing a credible fact base is paramount for designing and implementing an evidence-based just transition. This knowledge hub provides short summaries as well as key findings and recommendations from a diversity of reports, strategies, videos, and podcasts.
<https://www.tips.org.za/just-transition>
- **Just Urban Transitions information portal** – this information hub is created as part of the broader Just Urban Transitions project that focuses on unpacking the consequences of South Africa’s low-carbon transition, with a focus on the energy transition, for the urban context.
<https://justurbantransitions.com/>

- **PRESIDENTIAL CLIMATE COMMISSION - Towards A Just Transition –** this is an information portal for the Presidential Climate Commission, a multi-stakeholder body established by the President of South Africa to advise on the country's climate change response and pathways to a low-carbon, climate-resilient economy, and society.
<https://www.climatecommission.org.za/>
- **Towards a Just Transition: A Review of Local and International Policy Debates (Patel, M, 2021): Presidential Climate Commission** - this review, commissioned by South Africa's Presidential Climate Commission (PCC) forms part of a series of papers that will provide an evidence-based foundation for a new Framework for a Just Transition – a practical guide to ensure that South Africa's transition to a low-emissions economy is well managed, just, and equitable.
https://a9322a19-efe3-4459-9a6c-ab806fededa3.filesusr.com/ugd/1eb85a_74b5dedc930b48d2b074acc1432ba94c.pdf
- **SALGA Energy Summit Declaration (2018) – Defining the energy future of local government:** - The Summit addressed how the changing energy landscape affects municipalities economically, legally, financially, and institutionally, and how municipalities can respond to these changes. Six significant outcomes emerged from the Summit.
<https://www.salga.org.za/Documents/Documents%20and%20Publications/Documents/Final-Energy-Summit-Declaration-2018.pdf>
- **Small Scale Embedded Generation (SSEG) Municipal Resource Portal.** A SALGA–SEA–CSIR–GIZ SAGEN partnership initiative that provides a rich resource of all the documents required by a municipality to accommodate SSEG safely onto their distribution grids: <https://www.sseg.org.za/>
- **TIPS Coal value sector report:** The paper explores the cost of the just transition and what just transition approaches might accelerate transformation of the South African:
https://www.tips.org.za/images/report_Estimating_the_cost_of_a_just_transition_in_South_Africa's_coal_sector.pdf
- **Economic Impact Assessment of Hendrina Power Station in Mpumalanga (KPMG, 2018)–** this economic impact report highlights the economic contribution that Hendrina coal fired power station makes to Mpumalanga and the rest of South Africa: https://cer.org.za/wp-content/uploads/2018/02/Eskom-Hendrina-EIA-report_Final.pdf
- **An overview of the employment implications of the South African power sector transition (Meridian Economics, 2018):**
<https://sawea.org.za/wp-content/uploads/2018/08/SAWEA-Employment-in-SA-Power-Sector-July-2018-EMAIL-VERSION.pdf>

- **TIPS, 2019. Sector Jobs Resilience Plan: National Employment Vulnerability Assessment - Analysis of potential climate-change related impacts and vulnerable groups:** - provides a detailed analysis of the capacity of vulnerable communities, workers and businesses to adjust to climate change-related impacts in the coal, metals, transport-based petroleum, agricultural value chain and tourism sectors.
<https://www.tips.org.za/just-transition/item/4084-national-employment-vulnerability-assessment-analysis-of-potential-climate-change-related-impacts-and-vulnerable-groups>
- **Solal PV Industry Jobs Report 2021**
<https://www.sapvia.co.za/wp-content/uploads/2021/05/SAPVIA-PV-Industry-Jobs-Study-Report-COMBINED.pdf>
- **Coal transitions: risks and opportunities (Jesse Burton, 2018):**
<https://sa-tied.wider.unu.edu/sites/default/files/pdf/Event-28August2019-Burton.pdf>
- **2050 Vision and Pathways for a Just Transition to a low carbon, climate resilient economy and society (NPC, 2019):**
<https://www.nationalplanningcommission.org.za/assets/Documents/Vision%20and%20Pathways%20for%20a%20Just%20Transition%20to%20a%20low%20carbon%20climate.pdf>

9.7. Energy

- The **Urban Energy Support website** is an information portal of relevant documents and resources to support the transition towards sustainable local energy development and a low carbon trajectory for South Africa in the context of global climate change. <https://www.cityenergy.org.za/>
- **Sustainable Energy Solutions for South African Local Government – A Practical Guide** - This is a practical how-to handbook for local municipalities on the roll-out of sustainable energy measures. The first section focuses on governance and legislation (e.g., mandates, green procurement, institutionalizing of sustainable energy and climate change concerns, etc.; the second on municipal sustainable energy initiatives (e.g., solar water heating, efficient buildings, sustainable transport, etc.); and the third on macro developments (e.g., smart grids, concentrated solar, ocean energy, etc.)
<https://www.cityenergy.org.za/sustainable-energy-solutions-for-south-african-local-government-a-practical-guide/>

9.7.1. Energy Efficiency

- **The SALGA Local Government Energy Efficiency (EE) and Renewable Energy (RE) Strategy Guide** – provides a detailed programme of action to promote the development of EE and RE in municipalities. Full document available here:
<https://www.cityenergy.org.za/salga-local-government-energy-efficiency-renewable-energy-strategy-guide/>

- **The SALGA Local Government Energy Efficiency (EE) and Renewable Energy (RE) Strategy Guide - VIDEO**
This video provides a short description of the SALGA Energy Efficiency and Renewable Energy Strategy Guide. Video available here:
<https://www.cityenergy.org.za/?s=SALGA+video>
- **How to include energy efficiency and renewable energy in existing infrastructure grants - Information Guide for Municipalities**
https://www.cityenergy.org.za/uploads/resource_435.pdf
- **Guide for Energy Savings in Motor-Driven Systems at Municipal Wastewater Treatment Plants** provides information on how to reduce energy consumption in wastewater treatment plants, specifically through the maintenance and/or replacement of motors.
http://www.cityenergy.org.za/uploads/resource_488.pdf
- **Adapt and save. A Guide on Implementing Municipal Energy Management Systems** - shows municipalities how to set up an energy management system to save energy and reduce costs.
http://www.cityenergy.org.za/uploads/resource_486.pdf
- **Sustainable Energy Solutions for South African Local Government – A Practical Guide (SEA 2019)**
This is a practical handbook for local municipalities on the implementation of sustainable energy measures. The first section focuses on governance and legislation (e.g., mandates, green procurement, institutionalizing of sustainable energy concerns, etc.); the second on municipal sustainable energy initiatives (e.g., solar water heating, efficient buildings, sustainable transport, etc.); and the third on macro developments (e.g., smart grids, concentrated solar, ocean energy, etc.).
<https://www.cityenergy.org.za/sustainable-energy-solutions-for-south-african-local-government-a-practical-guide/>

9.7.2. Renewable Energy

- **The SALGA Local Government Energy Efficiency (EE) and Renewable Energy (RE) Strategy Guide** – provides a detailed programme of action to promote the development of EE and RE in municipalities. Full document available here:
<https://www.cityenergy.org.za/salga-local-government-energy-efficiency-renewable-energy-strategy-guide/>
- **The SALGA Local Government Energy Efficiency (EE) and Renewable Energy (RE) Strategy Guide - VIDEO**
This video provides a short description of the SALGA Energy Efficiency and Renewable Energy Strategy Guide. Video available here:
<https://www.cityenergy.org.za/?s=SALGA+video>

- **How to include energy efficiency and renewable energy in existing infrastructure grants - Information Guide for Municipalities**
https://www.cityenergy.org.za/uploads/resource_435.pdf
- **AMEU SALGA Small-Scale Embedded Generation (SSEG) Resource Pack. 2019.** A full complement of templates and documents for municipalities to establish sound SSEG permitting procedures, for the adoption of SSEG in a way that preserves the financial and technical integrity of municipal distribution systems and standardizes the approach across municipalities. <https://www.sseg.org.za/category/ameu-salga-resource-pack/>
- **Small Scale Embedded Generation (SSEG) Municipal Resource Portal.** A SALGA–SEA–CSIR–GIZ SAGEN partnership initiative that provides a rich resource of all the documents required by a municipality to accommodate SSEG safely onto their distribution grids. It also includes municipal training course presentations and training videos of the Municipal SSEG Support Programme, as well as a tariff model tool to measure the financial impact of proposed SSEG tariffs on municipal finances and to evaluate the business case for customers who have installed solar PV systems based on the proposed SSEG tariffs:
<https://www.sseg.org.za/>
- **Metering for Small-Scale Embedded Generation Information to Help Municipalities Understand and Procure Suitable SSEG Metering Systems**
<https://www.sseg.org.za/metering-for-small-scale-embedded-generation/>
- **How to set Solar PV/SSEG Tariffs.** A user friendly, easy- to-understand video conveying the practicalities of SSEG tariff setting to support South African municipalities with SSEG tariffs.
<https://www.youtube.com/watch?v=v0ra-NFqByY>
- **Small-Scale Embedded Generation (SSEG) Tariff Guidelines Summary**
<https://www.sseg.org.za/tariffs/>
- **The Impact of Small-Scale Embedded Generation on Municipal Revenue** <https://www.sseg.org.za/the-impact-of-small-scale-embedded-generation-on-municipal-revenue/>
- **Grid Impact Study Specification Guide**
This document sets out parameters and functionality to be checked in assessing whether an embedded generator can be connected to a municipal distribution network. It also stipulates methodologies considered acceptable and reporting requirements.
<https://www.sseg.org.za/grid-impact-study-specification-guide/>

- **Wheeling Discussion Paper: A Guide for Municipal Distributors**
Wheeling is the delivery of electricity generated by a private operator in one location to a buyer or off-taker in another location via a third party network (Eskom or municipality). Municipalities have made commitments to be carbon neutral by 2050 which would require them to enable/encourage alternative sources of renewable electricity. Moreover given emerging technology disruptions, most utilities recognise the need to move from an energy units based business model to selling grid services. Setting a wheeling tariff framework is a first step in this direction for municipalities.
<https://www.sseg.org.za/wheeling-discussion-paper/>

9.7.3. Energy Poverty

- **Alternative Household Energy Technologies**
This document guides on alternative energy technologies and associated energy sources available in the market that are cleaner, appropriate, applicable, and sustainable relative to those that are currently available and used by informal households for their domestic energy requirements.
http://www.cityenergy.org.za/uploads/resource_421.pdf
- **Interim Off-Grid Solar Electricity for Un-Electrified Informal Settlements - Policy Brief** – this brief makes the case for the policy opportunities for using off-grid solar electricity technology - specifically Solar Home Systems (SHS) - as part of an impactful, cost-effective, non-wasteful, but temporary investment in free basic energy delivery to eligible indigent residents of urban informal settlements.
http://www.cityenergy.org.za/uploads/resource_460.pdf
- **Informal Electrification in South Africa: Experiences, Opportunities and Challenges** - An overview of experiences, lessons, and challenges with informal electrification in South Africa, drawing primarily on eThekweni and Cape Town's informal electrification programmes (Sustainable Energy Africa, 2012).
<https://www.cityenergy.org.za/informal-electrification-in-south-africa-experiences-opportunities-and-challenges-2/>
- **Energy Poverty and Gender in Urban South Africa**
This report presents an update on the current state of energy poverty in South African. It explores the energy poverty-gender nexus in the urban environment, an aspect that is largely overlooked. The report addresses key factors influencing energy poverty and presents the manifestations of urban energy poverty; reviews the impact of key pro-poor energy policies and finally proposes gender-sensitive energy solutions for urban municipalities.
http://www.cityenergy.org.za/uploads/resource_432.pdf
- **(Modelling) The Financial Case for Rooftop Solar PV in Low- And Mid-income Households in South Africa**

This report evaluates the impact on municipal revenue and household electricity costs if a household invests in a grid-tied rooftop photovoltaic (PV) system. The model is intended for use as a broad policy making tool to evaluate trends and emerging opportunities for investments in rooftop PV systems for low- and mid-income households.

<https://www.sseg.org.za/wp-content/uploads/2019/10/Low-and-Mid-Income-Household-SSEG-ModelReport-FINAL-final.pdf>

9.8. Gender Considerations

- **Integrating Gender in Local Government Climate Change Policies and Programmes** - Gender CC – Women for Climate Justice, 2019:

<https://www.gendercc.org.za/wp-content/uploads/2020/02/Gender-CC-Integrating-Gender-In-Local-Govnt-Booklet-March-2019-00000003.pdf>

- **Addressing Gender Equality in Climate Change Adaptation. From Principles to Practice:**

<https://napglobalnetwork.org/wp-content/uploads/2019/05/napgn-en-2019-infographic-addressing-gender-equality-in-climate-change-adaptation.pdf>

- **Gender and Climate Change: South Africa Case Study:** this study funded by the Heinrich Boell Stiftung Foundation examines the gender differentiated impacts of climate change. The study also creates awareness amongst policy and decision-makers about the need for gender differentiated adaptation policies.

https://www.boell.de/sites/default/files/assets/boell.de/images/download_de/ecology/south_africa.pdf

9.9. Data

- **State of Energy in South African Cities reports 2006, 2011, 2015 and 2020**

These reports feature South Africa's most energy intensive cities and towns and tracks energy use in cities since 2007, presenting emerging trends in energy efficiency and renewable energy uptake, and examines the governance of transition (SEA, 2020).

<http://www.cityenergy.org.za/getfile.php?id=322&category=1>

- **Local electricity emissions factor calculator for municipal GHG Inventory development (SEA, 2021)** - This is a very helpful tool developed by Sustainable Energy Africa that allows a municipality to calculate a local electricity emissions factor, based on sources of electricity, including Eskom (including Eskom power plants and electricity bought by Eskom from IPPs and imports), IPPs (direct purchase by the municipality), own-generation (by the municipality) and small-scale embedded generation (SSEG) – assumed rooftop PV.

<https://www.cityenergy.org.za/local-electricity-emissions-factor-calculator/>

- Guide to Energy and Emissions Data Collection for South African Municipalities**
 This document provides municipalities with a detailed methodology on how to conduct data collation data for a Greenhouse Gas Inventory (SEA, 2017).
<https://www.cityenergy.org.za/guide-to-energy-and-emissions-data-collection-for-south-african-municipalities/>
- City-wide Mitigation Potential for South Africa: Technical Report -**
 provides an overview of the energy consumption and energy-related greenhouse gas emissions of urban centres in South Africa, and determines the extent to which these cities can reduce their emissions into the future, based on various energy efficiency and renewable energy interventions
http://www.cityenergy.org.za/uploads/resource_444.pdf and Decision-makers Report http://www.cityenergy.org.za/uploads/resource_487.pdf
- Energy Use for Polokwane Municipality** – this report shows projections of how municipal driven interventions may alter the path in reducing energy consumption and greenhouse gas emissions. This work was undertaken towards the development of the Municipality’s energy and climate action plan.
http://www.africancityenergy.org/uploads/resource_124.pdf
- Household Energy Use and Supply Survey of Dikgale Sub district of Polokwane, Limpopo (Polokwane) (2016)** - This survey looked at household energy requirements for cooking, lighting, heating, and cooling. The purpose of the survey was to gain an understanding of current energy use demands and needs, as well as household perceptions on energy use and awareness in Ga-Dikgale, Polokwane. This work was undertaken towards the development of the municipality’s energy and climate action plan. (Sustainable Energy Africa and University of Limpopo, 2016).
- Battery Electric Passenger Car GHG Emissions vs Conventional Passenger Car GHG Emissions: Technical Brief**
http://www.cityenergy.org.za/uploads/resource_401.pdf and Calculator <http://www.cityenergy.org.za/getfile.php?id=400&category=7>
- Well-to-Wheels Greenhouse Gas Emissions and Energy Comparison between Battery Electric Vehicles, non-Plug in Hybrids and Conventional Passenger Cars for South Africa** - Sustainable Energy Africa has developed an open-source spreadsheet calculator for comparing the greenhouse gas (GHG) emissions of conventional internal combustion engine (ICE) powered passenger cars to that of battery electric vehicles (charged from the national grid) and non-plug-in hybrids in the South African context. The emissions are estimated for the supply and production of the fuel and electricity as well as those from the vehicle itself (Wells-to-wheels basis). The coal intensive electricity and synthetic liquid fuel supply in parts of the country make the local situation unique.
http://www.cityenergy.org.za/uploads/resource_401.pdf

10. References

- Belynda, Petrie, Wolpe Peta, Reddy Yachika, Adriázola Paola, and Gerhard Michael. 2018. *MULTI-LEVEL CLIMATE GOVERNANCE IN SOUTH AFRICA Catalysing finance for local climate action*. Berlin, : adelphi,.
- Burton, Jesse. 2020. *Considerations for Just Transition in Mpumalanga*. Capetown: University of Capetown.
- CSIR. 2019. *Greenbook*. www.greenbook.co.za.
- DARDLEA. 2016. *Mpumalanga Province Climate Change Adaptation Strategy*. Mbombela: DARDLEA.
- DEA [Department of Environmental Affairs]. 2012. *Lets Respond Toolkit* : . Pretoria: Department of Environmental Affairs.
- DEA [Department of Environmental Affairs] 2015. *GHG National Inventory Report 2000-2015*. Pretoria: Department of Environmental Affairs.
- DFFE [Department of Forestry, Fisheries and the Environment]. 2011. "Strategic Documents." *Department of Forestry, Fisheries and the Environment*. available from: <https://www.environment.gov.za/documents/strategicdocuments>.
- DFFE [Department of Forestry Fisheries and Environment]. 2019. *Local Government Climate Change Support Programme – A practical systematic guide towards unlocking municipal climate financ*. Pretoria: Department of Forestry, Fisheries and Environment.
- DFFE [Department of Forestry Fisheries and Environment]. 2021. "South Africa's First NDC, 2020/21 Update." *Department of Forestry, Fisheries and the Environment*. available from: <https://www.environment.gov.za/documents/strategicdocuments>.
- DFFE [Department of Forestry Fisheries and Environment]. 2020. *South Africa's Low Emissions Development Strategy 2050*. <https://unfccc.int/sites/default/files/resource/South%20Africa%27s%20Low%20Emission%20Development%20Strategy.pdf>.
- Emalahleni Local Municipality. 2017-2022. *Emalahleni Local Municipality Integrated Development Plan (IDP)*. eMalahleni: Emalahleni Local Municipality.
- Emalahleni Local Municipality. 2019. *Air Quality Management Plan*. Emalahleni: Emalahleni Local Municipality.
- Emalahleni Local Municipality. 2020. *Integrated Development Plan*. Emalahleni: Emalahleni Local Municipality.
- ICLEI. 2020. *The Central KwaZulu-Natal Climate Change Compact, South Africa: A platform fostering multi-level governance for climate change*. Durban: ICLEI. http://www.durban.gov.za/City_Services/development_planning_management/environmental_planning_climate_protection/Projects/Documents/Urban-LEDS%20II_KZN%20CCC_Case%20study_Feb%202020.pdf.
- IPCC [Intergovernmental Panel on Climate Change]. 2014a. *Summary for Policymakers*. In: *Climate Change 2014: Mitigation of Climate Change*.

- Cambridge, New York: University Press, Cambridge. Accessed March 10, 2021.
- IPCC [Intergovernmental Panel on Climate Change]. 2014. *Climate Change 2014 Synthesis Report Summary for Policy Makers*. IPCC.
- IPCC [Intergovernmental Panel on Climate Change]. 2018. *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change*. Bonn: inPress.
- IPCC. 2021. *Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan*. Cambridge University Press.
- Just Urban Transitions. 2021. *Unpacking The Role And Tools For Local Governments In Coal-Affected Regions For A Just Transition*. Just Urban Transitions.
- KPMG. 2018. *Economic Impact of Hendrina Power Station*. KPMG.
- McKinsey Global Insititute.2019."Climate Risk and Response - Physical Harzards and Socio-economic Impact Report." available from <https://www.mckinsey.com/~media/mckinsey/business%20functions/sustainability/our%20insights/climate%20risk%20and%20response%20physical%20hazards%20and%20socioeconomic%20impacts/mgi-climate-risk-and-response-full-report-vf.pdf>
- National Planning Commission. 2019. *2050 Vision and Pathways for a Just Transition to a low carbon, climate resilient economy and society*. Pretoria: National Planning Commission.
- NPC[National Planning Commission] 2011. *National Development Plan 2030 Our Future-make it work*. National Planning Commission.
- Patel, M. 2021. *Towards a Just Transition: A Review of Local and International Policy Debates*. Pretoria: Presidential Climate Commission.
- Ramaphosa, Cyril. 2020. "Critical issue of climate change must not be relegated due to Covid-19 crisis." *News 24*. <https://www.news24.com/news24/columnists/cyrrilramaphosa/cyrril-ramaphosa-critical-issue-of-climate-change-must-not-be-relegated-due-to-covid-19-crisis-20200824>.
- SALGA. 2020. *Statuso of Small Scale Embedded Generation (Sseg) In South African Municipalities*. Pretoria: SALGA.
- South African Cities Network. 2014. *Emalahleni - Dirty, but keepng SA's lights on*. Johannesburg: South African Cities Network, University of Free State.
- StatsSA. 2019. *Four Facts About The Mining Industry*. Pretoria: Statistics South Africa.
- The Presidency. 2020. "Presidential Climate Change Coordinating Commission appointed." *The Presidency*. <http://www.thepresidency.gov.za/press-statements/presidential-climate-change-coordinating-commission-appointed>.
- The Presidency RSA. 2021. *Letter from the desk of the President on Climate Change*. Pretoria: The Presidency of the Republic of South Africa.

- TIPS [Trade and Industrial Policy Strategies]. 2019. *National Employment Vulnerability Assessment: Analysis of potential climate change related impacts and vulnerable groups*. South Africa: Trade and Industry Policy Strategies.
- UNFCCC. 2011. *Fact sheet: Climate change science - the status of climate change science today*. UNFCCC.
- UNFCCC. 2020. *Yearbook of Global Climate Action 2020 Marrakech Partnership for Global Climate Action*. Bonn: UNFCCC.
- UN Habitat. 2016. *World Cities Report 2016*, UN Habitat. Available at: <http://wcr.unhabitat.org/wp-content/uploads/2017/02/WCR-2016-Full-Report.pdf>.
- United Nations Climate Change. 2021. *Marrakech Partnership for Global Climate Action*. <https://unfccc.int/climate-action/marrakech-partnership-for-global-climate-action>
- United Nations. 2021. *Sustainable Development Goals, Goal 13*. <https://www.un.org/sustainabledevelopment/climate-change/>.
- WBGU–German Advisory Council on Global Change. 2016. *Humanity on the move: Unlocking the transformative power of cities: WBGU*. Available at: https://www.wbgu.de/fileadmin/user_upload/wbgu.de/templates/dateien/veroeffentlichungen/hauptgutachten/hg2016/hg2016_en.pdf
- WEF [World Economic Forum] 2019. *The Global Risks Report 2019 14th Edition*. Geneva, Switzerland: World Economic Forum.
- World Meteorological Organization. 2019. *WMO Statement on the State of the Global Climate in 2019*. Geneva: World Meteorological Organization (WMO).
- World Meteorological Organization,. 2020. *State of the Climate in Africa 2019*. Geneva: World Meteorological Organization,.
- Wolpe, Peta and Yachika Reddy. 2015. *The contribution of low-carbon cities to South Africa's greenhouse gas emissions reduction goals. Briefing on urban energy use and greenhouse gas emissions*. Stockholm Environment Institute, Available at: <https://mediamanager.sei.org/documents/Publications/Climate/Cities-low-carbon-future-2015-South-Africa-briefing.pdf>.
- Ziervogel, G. New, M. Archer, E. Midgley, G. Taylor, A. Hamann, R. Stuart-Hill, S. Myers, J. Warburton-Toucher,. 2014. *Climate change impacts and adaptation in South Africa*. Available from: https://www.researchgate.net/publication/263670072_Climate_change_impacts_and_adaptation_in_South_Africa

