# AN INVESTIGATION OF HOW THE GREEN AGENDA IS BEING INTEGRATED IN THE ENERGY SECTOR TO PROMOTE URBAN SUSTAINABILITY IN JOHANNESBURG.

**Supervisor: Dr. Tsepang Leuta**

**VIOLET PHIRI**

**A research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Urban Studies in the field of Urban Management.**

Johannesburg, February 2022

# 1 Declaration

I, Violet Phiri, declare that this research report, except where otherwise indicated is my original, unaided work and has not been submitted before for any other degree or examination to any other university. It is being submitted to the Degree of **Master of Urban Studies in the field of Urban Management** to the University of the Witwatersrand, Johannesburg.

……..…….

Violet Phiri

February,2022.

## 2 Abstract

The City of Johannesburg in South Africa and other global cities are on a drive to attain urban sustainability. However, the fragmented urban form of Johannesburg due to the legacy of the apartheid city spatial planning contributes to greenhouse gases emission in the city posing a challenge. Using a secondary data analysis and interviews, this study aimed to explore how the City of Johannesburg is integrating the green agenda into its energy policies to promote urban sustainability.

The research reveals that most of the City's spatial policies and interventions do not prioritize energy efficiency as a primary objective. Instead, the policies promote inclusivity through densification and compactness to solve the fragmented urban form using a polycentric model. However, this model primarily aims at inclusivity and reducing traffic congestion placing reduction of GHG emissions as a secondary function. The study recommends that the City should formulate energy policies that are targeted at promoting urban sustainability.

# 3 Dedications

To my parents, thank you for giving me the strength to reach for the stars and chase my dreams.

# 4 Acknowledgements

This work would not have been completed without the assistance of so many individuals.

Firstly, I would like to thank the Lord for his faithfulness upon my life, my coming to the University of Witwatersrand (Wits) and my stay in Johannesburg are a testimony of how great thou faithful is to me. Your grace has always been sufficient to me, despite COVID 19, you were there to strengthen me to go by with my studies without any difficulties.

I would like to express my deepest gratitude to my supervisor, Dr. Tsepang Leuta for the guidance, wise words, advice, patience, and encouragement rendered to me throughout the compiling of this research.

My greatest gratitude also goes to the DAAD Wits-TUB Scholarship team, Professor Sihlongonyane, Professor Huchzermeyer, Ms. Sithagu and the rest of the team for considering me for this scholarship to pursue this Master's Degree, I am forever indebted to you.

I am very thankful for the staff at the City of Johannesburg and at the National Energy Regulator of South Africa who took time to partake in this research and made it possible for me to gather the data I needed. I am also thankful for the support given by all the individuals who linked me to the people in these organisations.

To my parents, Mr, and Mrs Phiri, thank you for your love, prayers, encouragement, support and advice throughout my life. All my siblings, other family members and friends', thank you also for the support rendered to me. A special thank you goes to my former manager Mrs Lapukeni for granting me leave to pursue my studies.

Finally, I am grateful to all the wonderful people I met and reconnected with in Johannesburg, thank you for your love, kindness, support and for making my stay memorable.

# 5 Table of Contents

# 6 List of Figures



# 7 List of Tables

# 8 Table of Abbreviations

| | |
|---|---|
| BRT | Bus Rapid Transit |
| CoJ | City of Johannesburg |
| DoE | Department of Energy |
| EISD | Environment and Infrastructure Services Department |
| GCRO | Gauteng City-Region Observatory |
| GHG | Green House Gases |
| HSRC | Human Sciences Research Council |
| IDP | Integrated Development Plan |
| IRENA | The International Renewable Energy Agency |
| MMC | Members of the mayoral committee |
| MW | Mega watts |
| NCCRP | National Climate Change Response Policy White Paper |
| NGO | Non-Governmental Organisations |
| NERSA | National Energy Regulator of South Africa |
| SDGs | Sustainable Development Goals |
| SWH | Solar Water Heater |
| SWHP | Solar Water Heater Programme |
| TUB | Berlin Institute of Technology |
| UN | United Nations |
| UNDESA | United Nations Department of Economic and Social Affairs |
| UNFCC | United Nations Framework Convention on Climate Change |
| UNEP | United Nations Environmental Programme |
| WCED | World Commission on Environment and Development |
| WITS | University of the Witwatersrand |

# 1 Introduction

## 1.1 Introduction

The world has seen a rise in urbanisation with half the world population currently living in urban areas (United Nations Department of Economic and Social Affairs, 2018). The rise in urbanisation implies that a higher population are migrating from rural to urban areas for better opportunities such as employment, health care and education (Turok, 2016). Some studies have supported high densities in cities linking them to fostering economic development and creating inclusive and vibrant communities that foster proximity thereby contributing to social connections and networking (Liu and Ma, 2020). This has also been associated to inclusivity of various urban infrastructure and decreasing car dependence. Although, some studies are of the view that high population density have contributed to high levels of climate change and global warming in cities and hence lead to unsustainable urban areas (Johnsson *et al*., 2019). This has been because of high demand for services, energy, overwhelmed sanitation systems, high levels of uncollected waste, traffic congestion and the growth of informal settlements.

To address this, there has been a growth in discourse to promote sustainable cities and the green agenda has been argued by Pasquini and Enqvist (2019) as a tool that spatial planning can utilise to achieve sustainability. Many cities such as Amsterdam in the Netherlands are promoting urban sustainability by using spatial planning concepts such as densification, mixed land use planning, compaction among others (Arundel and Ronald, 2017). This is in line with the Sustainable Development Goal number 11 which advocates for safe, inclusive, resilient, and sustainable cities (United Nations, 2015).

Yet, some cities are still faced with challenges of attaining sustainability due to their urban forms. An example of such a city is Johannesburg which has unequal and fragmented urban form which was inherited from the apartheid system (Shackleton and Gwedla, 2021). During apartheid, races other than white were segregated from the economic activities and instead were in the periphery thus creating urban sprawl (Nero, 2019). This meant that they had to travel long distances to access economic opportunities such as jobs (*ibid*). This fragmented urban form is still present in Johannesburg today and people still travel long distances for work and to access other economic activities (CoJ,2018). This has contributed to the high GHGs emission from automobiles in the city.

In addition, Johannesburg has also been faced with effects of its population density and size. This has been intensified by the city being an economic powerhouse locally and internationally

(City of Johannesburg, 2018). As of 2018, the City of Johannesburg (CoJ) offers services to a population of about 5.04 million people (*ibid*). The high population is due to mass migration into the city. This has contributed to the high demand for energy, rise in urban poverty, shortage of housing thereby leading to informal settlements, a backlog in infrastructure development and maintenance and environmental degradation. These have increased the preservation of the sustainability of the city (CoJ, 2018). With the foregoing, the City has been prompted to integrate different strategies in the promotion of sustainability as will be discussed in this research. The structure of this chapter starts with a brief background on sustainability before undertaking the research problem and aim. It further discusses the research questions and methodology before providing the chapter outlines.

## 1.2 Background

The sustainable development definition popularised by the Brundtland Report in 1987 focused "on meeting the needs of the present without compromising the ability of future generations to meet their needs" (World Commission on Environment and Development [WCED], 1987: 6). Over the years, the definition has evolved with importance placed on fostering the ecological, economic, and social systems for human progression. This has trickled down to research and policy agenda as evident with the inclusion of sustainability in many international discourses (Bush, 2020). The deterioration of the natural environments due to the unsustainable use of resources contributed to the popularisation of the sustainability concept as argued by Sénit (2020) who states that countries were tasked with considering environmental policies in their economic policies, in their pursuit for development. This prompted the emergence of the concept on the global level.

Globally, there have been several treaties and agreements towards the promotion of sustainability. The United Nations Conference on Human Environment held in 1972 in Stockholm, Sweden was the first sustainability conference (Allen et al.,). Its aim was to find a common universal principle that the human population would use as a guidance on how to preserve the environment, to protect the earth and its inhabitants. In 1992, the Brazilian city of Rio de Janeiro hosted the Earth Summit. This conference aimed to place sustainable development at the core of protecting the earth from environmental degradation and the threats of climate change (UN, 2015). In 1997, the Kyoto Protocol took place. It extended the 1992 United Nations Framework Convention on Climate Change (UNFCC) with the aim of stabilising the concentration of greenhouse gases (GHGs) to a level that does not interfere with climate change. However, it only entered into force in 2005 (*ibid*).

In 2012, another conference took place in Rio de Janeiro called Rio20+. During this conference, the Millennium Development Goals, which were formulated in 2000 to address poverty eradication were replaced as the process of developing new goals began. This saw the formulation of the Sustainable Development Goals (SDGs). It was envisaged that the SDGs would address sustainable development in an integrated, sustainable, and global way. Therefore, in 2015, the 2030 Agenda for Sustainable Development was adopted by the 193-Member United Nations General Assembly in New York. This conference saw the formulation of 17 SDGs and 169 targets, which integrated environmental, social, and economic pillars (UN, 2015). For instance, the 11$^{th}$ SDG advocates for cities that are inclusive, safe, resilient, and sustainable. Similarly, Goal 7 advocates for sustainable cities, focusing on universal access to energy, increased energy efficiency and the use of renewable energy (United Nations, 2015). In 2015, the Paris Climate Conference was held and led to a new international climate agreement that aimed to keep global warming below 2°C, following the recommendations of the Intergovernmental Panel on Climate Change (United Nations, 2015). In 2016, the Sustainable Urban Development (Habitat III) was held in Quito, Ecuador. It was during this conference that the New Urban Agenda which recognises how urbanisation can be used to attain sustainability was adopted (UN, 2017).

One prominent feature that came out of these agreements and treaties was the need to cut on Greenhouse gases (GHGs) emissions, which are a major contributor to environmental degradation. Many countries incorporated the green agenda which is concerned with preservation and protection of the environment and mitigation against damage in different sectors such as infrastructure development, urban planning, and the energy sector among others (Muller-Eie, 2018).

South Africa has ratified most of the agreements and treaties mentioned above and places the right to a clean environment and sustainable development as a fundamental subject. This is evident with the inclusion of Section 24 of the Constitution (1996) which advocates for the protecting the environment and wellbeing of humans. Promotion of sustainability is evident in policies such as the White Paper on Energy Policy of 1998 and the National Climate Change Response White Paper of 2011. Furthermore, the National Strategy for Sustainable Development was formulated in 2011 to show government's commitment to combining environmental, social, and economic equity for the country. The National Development Plan affirms this position by stating plans to reduce the use of coal as a primary energy need by turning to gas and renewable energy sources (National Planning Commission, 2013).

Many provinces in South Africa have taken steps in promoting urban sustainability by integrating the green agenda. An example is the Gauteng Province, which put up several measures to promote sustainability like the Gauteng Integrated Energy Strategy. The Gauteng Provincial Department of Economic Development aims at application of green issues in all objectives and activities undertaken by either departments or local authorities in the province. At the local level, the City of Johannesburg has also taken steps to promote the green agenda through the formulation of policies such as the Energy and Climate Change Strategy and Action Plan and the Climate Change Strategic Framework.

However, Johannesburg is struggling with high levels of GHGs emissions, which could be attributed to the high demand for energy and use of motorised transport resulting from the surge in population induced by rapid urbanisation (CoJ, 2018). The access rate for electricity in the city is at 90% (CoJ, 2018), and this is used by industries and households. CoJ (2018:21) reports that manufacturing, cooking, lighting, and heating water use most of the city's energy. Electricity used in Johannesburg contributes 66.7 % to the total GHGs emitted in the city despite the plants that generate this electricity being based in Mpumalanga Province (Akinbami, Oke, and Bodunrin, 2021). Similarly, the City encourages the use of public transport through the use of the Bus Rapid Transit (BRT) and the Gautrain. Yet, the City is still struggling with high GHG emissions (CoJ, 2018) due to its unequal and fragmented urban form influenced by the impacts of the legacy of apartheid planning (Shackleton *et al*.,2018).

## 1.3 Introduction To the Study Area

### 1.3.1 Geography

Johannesburg (shown in figure 1.1) is in the Gauteng province of South Africa. It is located on the Highveld (eastern plateau) with an elevation of 1,753 (CoJ, 2018). The eastern part is flat with indigenous Bankenveld vegetation while the west and north of the city are hilly (*ibid.*). Johannesburg has no major water body located near it (Human Sciences Research Council, 2014). Thus, Johannesburg is dependent on the Vaal River for its water source (Turton *et al.*, 2006). It has a subtropical climate with hot summers which run from October to April, and winter runs from May to September (*ibid.*). Johannesburg is historically known for the massive gold deposits that were found near a place called the Witwatersrand (Mabin, 2013). Johannesburg has several urban nodes such as Roodepoort, Sandton, Rosebank and Randburg in addition to the original Central Business District.

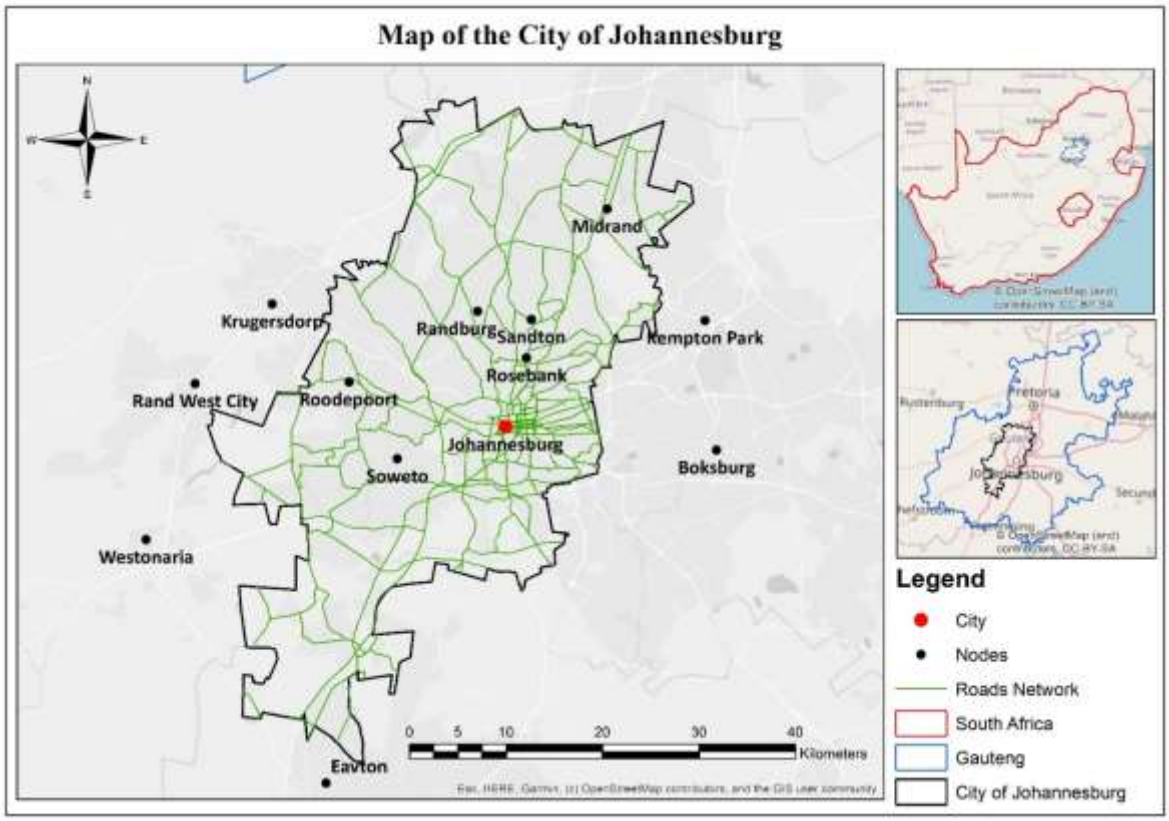



Figure 1.1 Map of Johannesburg, Source: Author's Formulation, 2020

### 1.3.2 Administrative Structure of Johannesburg

The governance structure of the City has the Executive Mayor who works as the head of the City and is assisted by the City Manager, executive directors, and members of the mayoral committee (MMCs) (Abrahams and Everatt, 2019). The directors are appointed administratively, and the members of the mayoral committee are political appointees. The Mayor plays a vital role in the development trajectory and strategic planning because he/she has the power prioritise areas for development around the City during his tenure of office which is usually five years (*ibid.*). The city is divided into seven regions overseen by a regional director who reports to the City Manager to ease service delivery. (Abrahams and Everatt, 2019).

### 1.3.3 Demographics of Johannesburg

Johannesburg has a population of 5.04 million, placing it as South Africa's populous city (CoJ, 2019). It has a relatively young population between the ages of 20-44 who make up half of the population. CoJ (2019) reports that in-migration is a major contributing factor with over 3000 people moving into the city every month and consequently, contributing to 3% of the city's population in the past 10 years (*ibid.*). The city has a population density of 3281 per $km^2$ in

2017 compared to 2000 people per square kilometre ($km^2$) in 2002 (Abrahams and Everatt, 2019). The population of Johannesburg is mostly made up of people of African origin who consist76%, whites make up 12% of the population while those who identify as coloured make up 6% of the population. Those who identify as being of Asian origin and of other races make up 5% and 1% of the population respectively.

### 1.3.4 Economic Profile of Johannesburg

Johannesburg is the economic hub of South Africa, and this is attributed to its central location (CoJ, 2019). It contributes about 16% to the national economy and 47% to the provincial economies (*ibid*). Of the city's population, 40% of those employed are either unskilled or semi-skilled, while 45% are categorised as skilled and 14% as highly skilled (CoJ, 2020). Johannesburg is still facing challenges of unemployment with the unemployment rate standing at 32,7%. The number of unemployed youths amounts to 40% of the overall unemployment proportion of the city according to CoJ (2020). The biggest employer in Johannesburg is the financial sector, followed by the trade sector. The city has witnessed a decline in industries such as mining, manufacturing, and agriculture due to inadequate natural resources (CoJ, 2018). This has resulted in the slow economic growth and employment opportunities present leading to social challenges which are characterised by high crime rate.

## 1.4 Research Problem and Rationale

Cities continue to be faced with the challenges of urbanisation and Johannesburg is no exception. As earlier stated, Johannesburg is faced with an urban fabric that is characterised by inequality and fragmentation due to effects of apartheid spatial planning (Shackleton *et al*.,2018). This has resulted in a contestation in land use leading to urban sprawl, an unsustainable use of energy consumption due to use of personal vehicles. These have attributed to an increase in GHG emissions despite investments in public transport systems to discourage the use of personal vehicles. This has also been coupled with the influx of migrants in the city causing an increase in the energy demand.

Despite the City’s efforts to address these challenges through formulation of different policies and strategies, there seems to be a disconnect between the formulation and implementation of these policies and strategies as observed from the high GHGs emitted in the city (CoJ, 2018). Drawing from this background, this research investigated if and how the green agenda is being integrated into the energy policy to promote urban sustainability in Johannesburg. This research

reviewed current policies and strategies on whether and there adopting and translating issues of sustainability and the green agenda.

## 1.5 Research Questions

How is the green agenda being integrated in Johannesburg to promote urban sustainability?

### 1.5.1 Sub-Questions

- What is the role of spatial planning in promoting urban sustainability in Johannesburg?
- What legislation and policies in the energy sector are directed towards promoting urban sustainability in Johannesburg?
- What is the green agenda, and how have different sectors in the City of Johannesburg integrated it to programmes or projects?

## 1.6 Aim of Research

This research aimed to explore how the green agenda discourse is being integrated in the current policies to promote urban sustainability in the City of Johannesburg. It also aimed to find out if the formulation and implementation of policies are aligning.

## 1.7 Research Methods Used in the Study

The research is a secondary data analysis which is qualitative in nature and followed a case study approach which employed both secondary and primary data to address the research questions. The City of Johannesburg was used as a case study. To assist in answering the research questions, policies and strategies that address sustainability such as the White Paper on Renewable Energy (2003), the Johannesburg Spatial Development Framework 2040, Gauteng Transformation Modernisation and Reindustrialisation Strategy, the 25 Year Gauteng Integrated Transport Master Plan, Local Government Energy Efficiency and Renewable Energy Strategy (2014), the White Paper on Renewable Energy (2003), the Energy and Climate Change Strategy and Action Plan: Climate Change Strategic Framework for City of Johannesburg were reviewed. To supplement the secondary data and fill in the gaps identified from policies, participants were interviewed. Purposive sampling was employed to select key staff in the Environment and Infrastructure Services Department and Department of Development Planning in the City of Johannesburg. A member of staff at the National Energy Regulator of South Africa (NERSA) was also interviewed to find out if their policies align with those of the CoJ. The purpose for the interviews was to bridge the gap on information that is not available in secondary data. An interview schedule was administered using Google forms

as a data collection tool. Protocols of ethics were adhered to in this research. The identities of the respondents who took part in this research were kept anonymous and their views were not misrepresented.

## 1.8 Key Terms

The key terms are defined by this study as;

Green agenda as adopted by this research is “that which is concerned with the protection of the ecosystem through formulating means to mitigate the deterioration of the natural environment using different principles of spatial planning such as mixed land use, green infrastructure and transition to renewable energy to promote sustainable urban areas.”

Sustainability is defined as the process of keeping a system preserved by reducing adverse effects, which are anchored in environmental, social, and economic pillars.

Urban sustainability is defined as the process of integrating systems that make up a city such as economic, environmental, and social to improve the lives of the residents in the long term with a consideration of areas beyond cities

## 1.9 Organisation of the Research Report

This research is divided into five chapters, the first chapter introduces the study. The second positions the study on existing literature on the sustainability concept, spatial planning, and the green agenda. The third chapter focuses on the methods employed to collect and analyse data, sampling techniques and the ethical standards adhered to. The fourth chapter presents the findings and analysis of key policies and strategies reviewed for the study and how they are addressing urban sustainability. Chapter five concludes the research by drawing key conclusions from the research findings and their implications on urban management and ends with recommendations.

# 2 Situating the Sustainability Concept in Theory

## 2.1 Introduction

Urban sustainability has become a key concept in the cities of the South due to rapid urbanisation and globalisation. To improve the deteriorating urban conditions, strategies must be put in place. One such strategy is the green agenda which plays an increasingly key role in keeping the GHGs stabilised, especially in the City of Johannesburg, which is the study area for this research. Hence, the objective of this chapter is to situate this study in previous scholarly works to identify the gaps that may exist between this work and other scholars.

This chapter is divided into four parts. The first part maps the sustainability concept; the second part presents the conceptual framework which guides the chapter; the third part focuses on the link between sustainability and the green agenda, and the fourth part discusses how spatial planning affects urban sustainability.

## 2.2 Mapping of the Sustainability Concept

The sustainability concept might have recently gained prominence and popularity in theory; however, it has existed since the 1700s where it has been said to stem from the discipline of economics derived from Malthusian population theory as argued by Mensah (2018) who cites Pigou (1920). It is argued that Malthus in his theory postulated that the human population grows in a geometric progression whereas matter grows in an arithmetic way (*ibid*). He judged that these varying types of growth could lead to population growth outstripping the capacity of the earth and its natural resources. He further suggested that if no measures were taken into consideration to check the increasing population growth rate, natural resources would deplete (Mensah 2018). Yet, this postulation was ignored on assumption that technology would annul such circumstances. However, with time, there was a rise in global concerns about the depletion of non-renewable resources which threatened long-term economic growth leading to environmental degradation (Liu and Ma, 2020). Arising from these concerns, the UN led the call by organising the conference on Human Environment in Stockholm, Sweden in 1972. It was resolved at this conference that countries should align their economic policies to environmental policies in their pursuit of development (Shi *et al*., 2019). This conference also saw the birth of the United Nations Environmental Programme (UNEP).

However, the biggest turning point for sustainability was in 1987 when the World Commission on Environment and Development chaired by Gro Harlem Brundtland renewed the call for sustainability leading to the renowned definition of sustainable development “as development

that meets the needs of the current generation without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development [WCED], 1987: 6). This was published in the Brundtland Report entitled "Our Common Future" in 1987.

The Brundtland Report engendered several conferences on sustainability. Needless to say that the consistent theme from these conferences has been addressing issues of the environment and economic development in cities around the globe. This has also been ignited by rapid urbanisation and environmental deterioration (Keitsch, 2018). Consequently, this rise has resulted in modification and redefinition of sustainability as per Brundtland Report. For example, Campagnolo *et al*. (2018) define sustainability as a paradigm that calls for refining the living standards without causing harm such as deforestation or pollution to the earth's ecosystem that can result in problems.

This study defines sustainability as the dynamic balance of human activities and the ecosystem such that the development activities of human beings should not harm the ecosystem upon which humans depend for survival. This translates to mechanisms where the three pillars (social, environmental, and economic) of sustainability interact without risking damage to resources. Accordingly, it calls for the development paradigm that enhances the improvement of living standards without causing environmental degradation and jeopardising the ecosystem that can lead to climate change (Shi *et al*., 2019). Thus, to achieve sustainability, several principles that gravitate towards ensuring a balance in social, environmental, and economic dimensions of cities must be in place (Geun, 2018).

The Brundtland Commission Report was followed by a series of conferences focused on sustainability and environmental protection, starting with the United Nations Conference on Environment and Development held in 1992 in Rio de Janeiro where the Local Agenda 21 was adopted (Xavier *et al*., 2019). The Local Agenda 21 recommended that national strategies should be developed to address the social, economic, and environmental aspects of sustainability (Allen *et al*., 2018). It also recognised the role different stakeholders can play in sustainability through active participation at the local level (Xavier *et al*., 2019). In addition, the Local Agenda 21 places the local authority as the best candidate for implementing strategies and plans because of its close association with the community and stakeholders (ibid). Then 20 years after the first Rio Earth Summit, the United Conference on Sustainable Development (also known as the Rio+20) was held. Its focus was on the institutional framework and the

green economy (Allen et al., 2018). One of the major outcomes was the process of developing the new Sustainable Development Goals which were to take effect in 2015.

In 2015, the United Nations Sustainable Development Goals were adopted by 193 UN member states in New York City (UN, 2015). This conference saw UN member states formulating new sustainable development objectives that were aligned to the Brundtland Report's general principles (ibid). The formulation of the SDGs has contributed to a different understanding of the sustainability concept, and it has provided a transformative action framework (UN, 2015). Amongst the SDGs is goal 11 which advocates for sustainable cities. This goal has contributed to the surge in global policy and scientific studies to promote safe, inclusive, resilient, and sustainable cities thus calling for an urgent response from governments (Huang *et al.*, 2018). This upsurge has been fuelled by the rapid deterioration of cities caused by the rise of urbanisation (Lui and Rasso, 2021) with the UN (2018) estimating that over half the population in the world lives in urban areas and an estimation that by 2030, over 60% of the world population will be living in cities.

## 2.3 Conceptual Framework

The conceptual framework in Figure 2.1 below is the visual representation of the concepts underpinning this study and the projected cause-effect relation of this research. Urban sustainability is the overarching argument of this study. Thus, to achieve urban sustainability, this research views spatial planning and its concepts such as compaction, densification, mix-land use planning, green infrastructure and partnerships and participation as the driving force. The research considers the green agenda as the catalyst for achieving urban sustainability through its interconnection to spatial planning. This is because it plays the role of preservation, mitigation, and filtration (Pasquini and Enqvist ,2019). For example, in compact cities, the green agenda plays the mitigation role of encouraging proximity hence reducing the usage of vehicles and reducing the emission of GHGs (Bibri *et al*, 2020). Therefore, it plays a role in promoting the environmental, social, and economic goals of sustainability. The debates and links will be discussed further in this chapter.

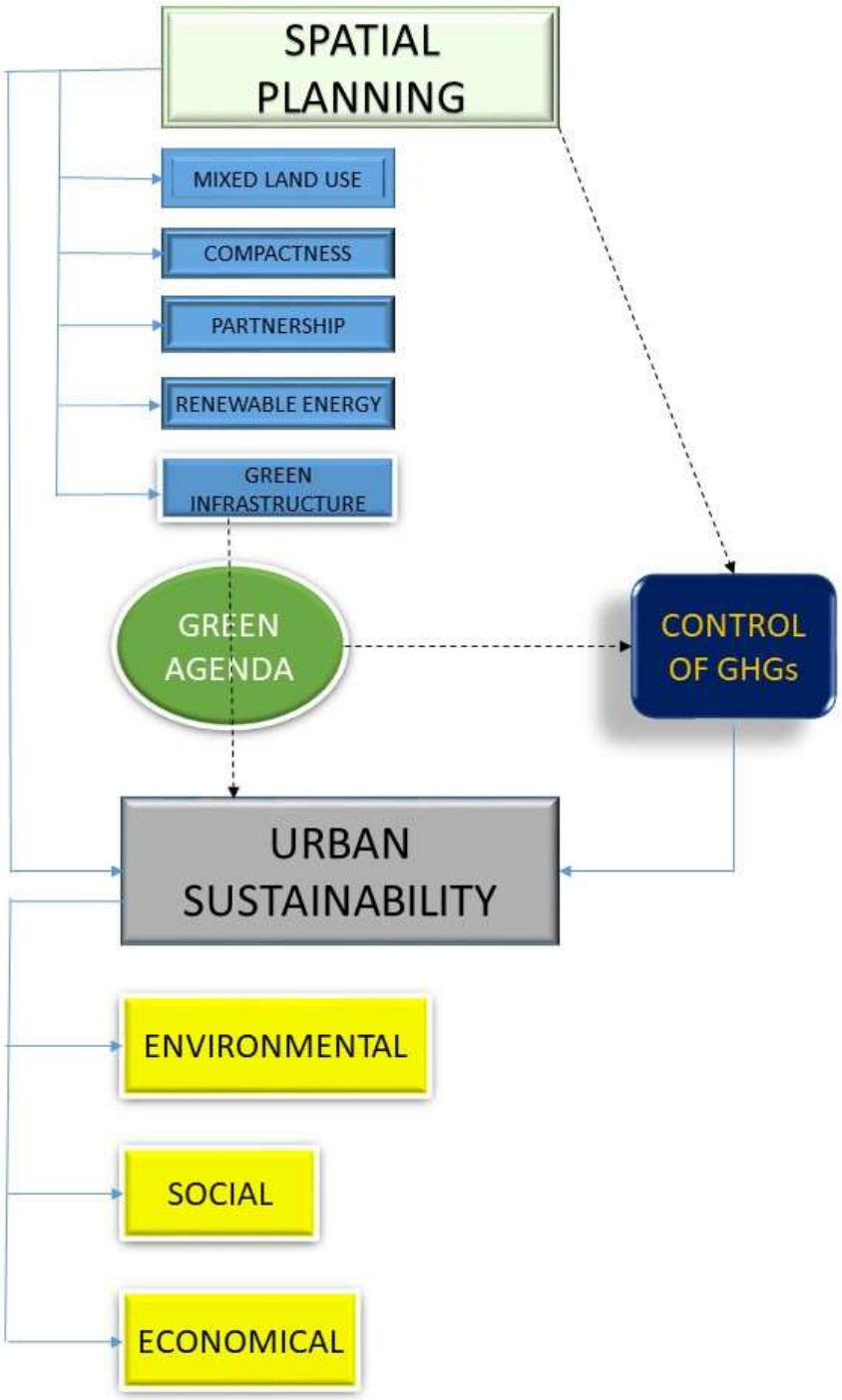



Figure 2.1 Conceptual framework showing the relationship of Spatial Planning, the Green Agenda and Urban Sustainability, Source: Author's Own, 2021.

## 2.4 Towards a Sustainable City

As earlier stated in this chapter, there is a rapid surge of urbanisation in the global South. Geo and Zhang (2020) notes that while the rapid urbanisation accelerates economic development in urban areas, it also come along with its associated adverse effects. Some of the effects being witnessed in cities rapidly urbanising includes among others extreme weather conditions, loss of biodiversity and land ecosystem and services (IPCC, 2019). This deterioration has prompted cities to seek strategies that promote a shift towards more sustainable pathways. The IPCC (2018) suggest that to lower the vulnerability that urban areas are facing and to enhance their resilience, there is a need to make specific changes that ensure sustainability. Lui and Rasso (2021) agree with this assertion by suggesting that policies and government systems that relate to land use planning can contribute not only to sustainable urban development but also to preserving ecosystem services. Furthermore, Escobedo *et al* (2019) also suggest that planning policy can use tools such as urban greening to reduce the impacts and pressures urban areas are facing due to rapid urban development. This study affirms that if anchored on firm governance systems, spatial planning can be used as a tool of achieving sustainability in urban areas by creating coherent territorial organisations of land use and balancing developmental needs to protect the environment and to achieve economic and social objectives. An urban green agenda is an important tool of spatial planning because of its ability to reduce energy costs, promote social cohesion, moderate rising temperature among others (Ureta *et al*., 2021).

For this study, urban greening is part of 'the green agenda'. The green agenda is noted by Pasquini and Enqvist (2019) as a vital element in ensuring urban sustainability by generating critical resources through filtration, preservation, and mitigation. it is a broader concept which ensures the efficient use of land and other natural resources, decreased waste generation, protection of water bodies among others. It ensures the prevention of resource degradation and loss of natural systems (Högström, *et al.*, 2021). Though it has recently gained prominence, the green agenda can be traced back to the 1980s where it was recognised as an approach to increase the quality of urban areas and the wellbeing of city dwellers (Huang *et al.*, 2018). It has been recognised by practitioners, policymakers, and researchers as a vital mitigation measure against rising temperatures, air pollution, stormwater management hence enhancing sustainability in urban areas (Ureta *et al*., 2021).

Based on this background, this study sought to find out the role the green agenda plays in energy policy to promote urban sustainability in Johannesburg. This has been stirred by the unequal and fragmented urban form of Johannesburg inherited from the apartheid spatial

planning system which placed races other than whites far from the centre of the city thus contributing to urban sprawl in the city (Shackleton and Gwedla, 2021). Due to this urban form characteristic, there has been an increase in the use of personal vehicles leading to unsustainable energy use. This has also been coupled with the influx of migrants in the city who have contributed to the high demand for energy use which have contributed to emissions of GHGs (CoJ, 2018).

Alluding to this, the green agenda is placed as the appropriate measure of combating the GHGs emitted due to the unsustainable use of energy. This argument is supported by Pasquini and Enqvist (2019) and Gao and Zhang (2020) who have argued that for the successful attainment of urban sustainability in cities, the green agenda can be used as a spatial planning tool to combat the effects of GHGs emissions. To this regard, the definition adopted by this study for the green agenda is that which is concerned with the protection of the ecosystem through formulating measures to mitigate the deterioration of the natural environment using different principles of spatial planning such as mixed land use, green infrastructure, transition to renewable energy to promote sustainable urban areas. This places spatial planning at the core of ensuring sustainability in cities through the formulation of policies and strategies that include but not limited to broadening the basis of mixed land use strategies, carbon neutral strategies, increasing urban density. These principally contribute to decreasing GHG emissions hence mitigating climate change (Arioli *et al*., 2020).

### 2.4.1 The Role of Spatial Planning in Promoting Sustainability in Cities

The rapid changes in urban areas have contributed immensely to the evolution of spatial planning from traditional master planning into a strategic form (Chigudu and Chirisa, 2020). Cilliers and Victor (2018) state that spatial planning is tasked with various facets that include land-use, social demands on spaces and protecting the earth's carrying capacity. This mandates spatial planning to act as the equilibrium between these different dimensions of sustainability. Chigudu and Chirisa (2020) agree by noting that spatial planning ensures this through the utilisation of land resources in a manner that meets current needs of people and those of future generations.

Spatial planning has further been labelled as a 'switchboard' that can facilitate the adaption, mitigation, and development of low-carbon cities by enabling long term reductions and control of GHGs emissions in urban areas (Wang *et al.*, 2015). Zhang *et al.*, (2021) note how spatial planning contributes to the development of integrated policies and strategies at both local and regional levels which advocate for low carbon cities. However, Moffat *et al* (2019) note that in

the global south, there is a lack of efficacy in spatial planning because cities are faced with challenges of facilitating transformations. This study agrees with the views of Moffat *et al*. (2020)'s argument based on the gaps observed in cities in the global south which are characterised by challenges of poverty, informality, rapid urbanisation, inequality, and spatial fragmentation, though this is not only limited to cities in the global south. The challenge that spatial planning faces in the global South are that most planning systems have been inherited from previous colonial governments or are adopted from the global north to suit the local context which in most cases does not fit well (Shackleton and Gwedla, 2021). This contributes to the many fragmentations in urban planning being experienced in the Global South (*ibid*).

For example, the fragmentation of the urban form because of inherited planning systems is very evident in the South African context (Makakavhule and Landman, 2020). The apartheid system which disadvantaged people based on their race where 'Black' 'Asian' and 'Coloured' were forcibly removed to the outskirt of the cities to avoid interaction with the 'White' race (Shackleton and Gwedla, 2021). Despite this law being dismantled in 1994 with the establishment of democracy which came with defined socio-economic priorities, the legacies of apartheid are still felt in the everyday life of South Africans (Venter *et al.,* 2020). This is despite the government's efforts of aligning policy towards transformation (Horn, 2019).

The transformation has been witnessed spatially on how the country has addressed the negative impacts aggravated by apartheid spatial planning by promoting inclusivity and equality (Busayo *et al*, 2019). This has been strengthened through the enactment of the Spatial Planning and Land Use Management Act 16 of 2013 by the government (*ibid*). One of the functions that the Act serves is to promote sustainable communities from the effects of climate change on the environment and places the local government authorities to champion the promotion of sustainable communities (*ibid)*. In addition to the SPLUMA is the Spatial Development Framework which municipalities use to outline their spatial vision and implementation.

Still, some scholars such as Zhang *et al.* (2021) argue that despite having policies in place, spatial planning is ambiguous in promoting urban sustainability and tackling climate change. Their argument is that spatial planning factors such as population density, urban patterns and public transport facilities influence and contributes immensely to the emission of GHGs. These indirectly contribute to the degradation of the natural environment, uncoordinated development and indirectly cause challenges in achieving sustainability (Liu and Ma, 2020). This study agrees with the views that planning is ambiguous because in its quest to promote sustainability in cities, there has been a rise in informal settlements which are characterised by urban poverty

due to failure to provide services to the ever-increasing urban population. This causes stress on the already existing burdened urban infrastructure services leading to unsustainability in cities.

Nevertheless, despite these complexities, spatial planning has other dimensions that can be used in cities to achieve sustainability. As observed by Högström *et al*. (2021: 1) "spatial planning process can be utilised in local planning practices to contribute to the realisation of established goals and objectives." Similarly, as stated by (Cilliers; 2019; Pasquini and Enqvist, 2019) the green agenda can be mainstreamed in spatial planning to reduce the rate of GHGs emissions and increase resilience and sustainability in cities. However, while spatial planning holds the promise to influence change in urban development trajectory, planners are still faced with dilemma on the best practices to apply when trying to balance competing needs. Some of the approach's planners apply in the quest to achieve urban sustainability opted by this study will be discussed below.

#### 2.4.1.1 The Rise of Mixed Land Use Planning

Urban planners have for long-time practised zoning regulation and land use segregation as a guiding principle to shape cities (Lv *et al*., 2021). The segregation of land use was used to separate different locations based on compatibility to avoid unintended environmental conditions that were caused by the industrial revolution (Raman and Roy, 2019). At the time, this proved to be what was the best practice because residential areas were segregated from commercial and industries. However, with time, practice and scholars found that single land use zoning was problematic for cities. This is because there was an increase in urban sprawl, the vitality of city centres declined, car dependence increased leading to traffic congestion (Raman and Roy, 2019)

To solve these problems, there was a call for mixed land use which entails for a combination of commercial, economic, industrial, office, and other land use in one neighbourhood (Broekhoven and Vernay, 2018). Mixed land use has been noted by Raman and Roy (2019) as a constructive tool in fostering community development, employment generation, promoting local economic development, non-motorized transportation, densification, reducing landscape fragmentation and providing closer proximity of public services. This places mixed land use as an essential tool in contemporary planning practice and theory as it fosters urban sustainability and smart growth (Korthals, 2019).

Scholars have advocated for mixed land use as essential in promoting sustainability in cities because there is a reduction in dependence on personal vehicles resulting in reduced GHG

emissions due to the closeness in proximity of various services. On the economic front, mixed use planning influences the value of land and buildings consequently resulting in increased levies for local authorities (Nabil and Eldayem, 2015). Also, because these zones attract a lot of people, this leads to an increase in economic activities. Broekhoven and Vernay (2018) have argued in support of mixed land use due to the social benefits of communities because of a diverse housing type provision for residents who might have different incomes. This provides them with a variety to choose from. Cities like Toronto which adopted mixed land use planning by allowing commercial and residential areas to co-exist due to the growing population has seen a rise in high rise buildings with apartments, amenities, and shops making access easy for the residents (Charmes and Keil, 2015).

However, this study is of the view that mixed land use can be problematic because the overlapping of the different zones such as commercial, industrial, and residential can lead to different types of pollution such as air and noise to the urban population. Also, due to the overlapping of various zones, the urban environment can be affected by the pollutants that are released from heavy trucks that deliver goods and services to industries and commerce (Pan *et al*., 2020). This can affect the sustainability of urban areas by contributing to climate change. Nevertheless, this study considers the pros outweigh the cons of mixed land use compared to mono-functional zoning which segregates various activities.

#### 2.4.1.2 Innovations in Planning through Densification and Compactness

##### 2.4.1.2.1 Compact City

The urban form of a city is essential to urban planning because it can lead to either the sustainability or the unsustainability of the city as argued by Kakar and Prasad (2020). The development of urban forms such as urban sprawl has been argued by Nengroo *et al*., (2017) to be a menace to urban development because it influences the accessibility of facilities. It further leads to dependence on personal vehicles, loss of land resources and pollution whereas the development of compact cities has been praised because it encourages closeness in proximity for different economic activities (*ibid*).

In this regard, urban planners have suggested compact cities as means of safeguarding and operating successful urban transport systems to ensure sustainability as argued by Bibri *et al*. (2020). Compact cities is one of the prominent global concepts about sustainable urbanism which emerged in the 1990's (Bibri *et al*, 2020). This model has been linked to combating issues of urban sprawl through the closeness of various land uses. Through its various publications, the UN (2018) has argued that the compact city model promotes social cohesion, resource efficiency and healthy

citizens. This model combats the issue of urban sprawl. It proposes high building densities in the city centre with varied land uses near each other, accessibility to these varied uses and efficient infrastructure and service provision (Tappert and Drilling, 2018).

This argument has been supported by other scholars such as Bibri, (2020), Iizuka *et al.,* (2020) who argue that compact cities are a useful tool to promote sustainability in spatial planning by reducing car dependence, decreasing the time it takes to travel hence shortening commuter time, decreasing the per capita energy use, mitigating pollution, and decreasing the loss of green areas around urban areas. This is justified because compact cities encourage mixed land and social use, intensifying development and encouraging the use of public transport (Bibri *et al*, 2020). This has been supported by Basso (2019) who argues that the use of public transport such as Bus Rapid Transit has not only reduced the time travel for passengers but also the energy use leading to reduced emissions of pollutants in the atmosphere from vehicles.

The compact city paradigm has grown around the world because it promises sustainability for cities (Tappert and Drilling, 2018). Cities in the Netherlands have taken the lead in integrating the compact city paradigm in their urban planning (Arundel and Ronald, 2017). This is because the concept of the compact city has taken centre stage in the national planning policy of the Netherlands. A prominent feature that has been constant in policies formulated has been limiting usage of personal vehicles, protecting landscapes, and sustaining public transport (*ibid*). Amsterdam has taken up the national policy by ensuring the integration of the principles of the compact city through building new housing and economic activities in nodes around the city, transforming old buildings into mixed use (commercial and residential), building high rise buildings to make up for the inadequate space and creating an efficient public transport system that prioritises new office spaces and housing (Arundel and Ronald, 2017)).

Nevertheless, despite its multi-use characteristics such as non-motorised transportation and the use of public transport, the compact city has shortfalls such as creating unsustainable living conditions and a diminished quality of life in the inner city (Tappert and Drilling, 2018). This study agrees with Tappert and Driling (2018) because the closeness in proximity leads to gentrification, which is accompanied by deterioration in open spaces, crime, limiting people's freedom from choosing diverse possibilities such as spacious living and reduced economic prospects. This could be a disadvantage to the promotion of urban sustainability especially if open spaces have deteriorated because open spaces play a lot of functions in the urban areas such as improving air quality, urban heat island and temperature regulation (Javadi, 2021).

#### 2.4.1.2.2 Densification

Densification is another urban growth model that opposes urban sprawl. Planners have resorted to compact cities and densification to counter the growth of urban sprawl because of the economic and environmental benefits they possess (Yunda and Sletto, 2020). Cities that are dense and compact are said to be more sustainable compared to the low-density ones. Whereas living in low density areas was viewed as getting closer to the countryside, it is now viewed as unsustainable to the environment due to depending on cars for mobility (Kim and Li, 2021). In addition, low-density cities (urban sprawl) cost cities a lot of resources when implementing infrastructure and network projects.

On the other hand, high density requires less land when implementing developmental projects and is favourable for the environment (Raman and Roy, 2019). This positively impacts urban public health for inhabitants of cities. This has been witnessed in Canada and France where urban planners are using densification to counter urban sprawl and the negative impacts that come with it (Charmes and Keil, 2015). This has been done by building high-rise buildings both in the inner city and the urban fringe to encourage densification.

However, this study is of the view that while smart city growth policies are promoting densification, dense urban form can disrupt the social and ecology of cities (Yunda and Sletto, 2020). This is because if cities are wrongly planned, accessibility for public transit and walkability due to space might not be achieved (Lehmann, 2017). Also, cities with high rise buildings are faced with issues of the urban heat island as observed in cities like Hong Kong thus promoting unsustainability (Carville, 2017).

Further, densification in cities cannot go without transit -oriented development because it fosters easy accessibility along transit corridors (Curtis *et a*l., 2016). Carville (2017) notes that the integration of land use and transit is an important strategy for sustainable cities. This facilitates proximity, accessibility, and high frequency travel. Transit-oriented development has been successful in high density cities such as New York and Manchester by increasing accessibility of economic activities and alternatives to personal vehicles (Khan and Carville, 2017). This places it as an integral part of spatial planning to promote urban sustainability.

### 2.4.1.3 Improving the Quality of the Environment through Green Infrastructure

Green infrastructure gained prominence in the late 1990s with researchers from mostly Europe and North America championing it (Mell, 2017). It has presented Urban Planners with an opportunity to develop innovative and multi-functional plans that deliver diverse benefits in

cities. Cilliers (2019) views the function of green infrastructure from a spatial point of view as a concept that enhances and supports the function of green assets and ecology to sustain and build resilience. Meerow (2020:2) defines green infrastructure as the connection of green spaces that promote the preservation of ecological systems to benefit humans. It is important to note that green infrastructure is not only confined to trees, but also includes parks, gardens, and urban agriculture among other spaces.

Green infrastructure has seen considerable growth in the global north, especially in the United States where it has been viewed as the reconciliation factor between environmental conservation and economic growth (Mell and Clement, 2020). Yet, in Africa, green infrastructure is viewed as a luxury. Cilliers (2019) notes how in the African context, green infrastructure is not viewed as a necessity compared to other social issues. She gives an example of South Africa where green infrastructure planning is given limited priority compared to other social issues. In support of this argument, Zuniga *et al.* (2020) note that with green infrastructure, priority is given to suburbs while the poorer areas lag. The uneven distribution of green infrastructure relates to what was earlier stated in this study on how many systems are still struggling with colonial inheritance. In this case, the uneven distribution of green infrastructure can be traced from the apartheid spatial planning which deprived services to poorer neighbourhoods (Shackleton and Gwedla, 2021).

Therefore, with the coming of democracy, the government saw it fit to improve the lives of the poorer neighbourhoods by providing social services, and green infrastructure was deemed to be a luxury thus not much attention was given to it (Zuniga *et al.,* 2020). This argument was confirmed by Pasquini and Enqvist (2019) and Shackleton *et al*. (2018) whose studies revealed uneven distribution of green infrastructure in many South African cities between previously disadvantaged and wealthier neighbourhoods.

Nevertheless, the post-apartheid government has tried to reconcile the spatial inequalities by building social houses with little consideration of environmental justice and quality of life (Venter *et al.*, 2020). This has worsened the already existing unequal distribution of green infrastructure due to the minimal consideration of urban greening in new areas thereby further widening the gap that was left by the apartheid government. Makakavhule and Landman (2020) agree by stating that the spatial distribution in South Africa reflects the legacies of apartheid due to the visible inequalities around the country. Staddon *et al.* (2018) state that this scenario has been mirrored through the dissatisfaction of residents in poorer areas who voice their displeasure on the poor delivery of quality public green spaces compared to white dominated

neighbourhoods. These occurrences have manifested dissatisfaction in the vandalism of infrastructure and resistance to change because the African community feels that the government has let them down (Shackleton *et al.*, 2018).

Cilliers (2019) attributes the ambitions of politicians to gain influence by providing social services such as housing, water, and healthcare as urgent needs. However, this study is of the view that politicians take the route of providing social services such as health care and education as a priority because of the urgency of such services to the population. This can also be attributed to the fact that it is easy to shift from grey to green infrastructure in wealthier areas because green infrastructure projects normally happen when a neighbourhood already has grey infrastructure in place which is the case with wealthier neighbourhoods (Zuniga-Teran *et al*., 2020). This mere fact makes it difficult to implement green infrastructure projects over grey infrastructure projects in poorer areas because poorer areas need several basic services that they lack. This places the politicians with no choice but to place green infrastructure as a luxury and service provision as a priority. Nonetheless, due to its multifunctionality, this study recognises the importance of green infrastructure as a factor of spatial planning in promoting urban sustainability because of its capability to connect landscapes, urban heat islands, promote air quality and management of storm water (Iizuka *et al*., 2020).

#### 2.4.1.4 Effective Policies and Governance Structures

Adequate policy formulation and implementation are critical in spatial planning (Högström *et al*., 2021). In the last decade, there has been a growing body of research on the role of spatial planning in urban governance. The emphasis has been on how spatial planning can be intertwined with structured wider social, economic, and environmental forces to promote urban development (Schmitt and Wiechmann, 2018). This shift of spatial planning towards governance has provided local governments with a complex task of executing national and local visions. The focus of local government as development facilitators is as per the recommendation of the Local Agenda 21 where local government were placed to be the implementors of strategies due to their close association with the community (Xavier *et al*., 2019).

However, this can only be successfully achieved with support and coordination from other spheres of government such as the national and regional governments (Schmitt and Wiechmann, 2018). This is as per the argument of Schmitt and Wiechmann (2018) who argue that coordination as a vital factor in the implementation of policies suggests that for policy formulation, different levels of government must coordinate. This leads to successful filtration

of policies from the top to the bottom where the policies are implemented in this case from the national government to the local government who closely work with the community (*ibid*). The local authority must be trusted by the central government to execute their functions without intense interference, thereby allowing local authorities to effectively function. Though this study is of the view that in many cases local authorities struggle with the implementation of policies due to different challenges such as finances, human resources, and political interference. These challenges have been witnessed in Africa where policies concerned with the green agenda are not given adequate attention compared to other social issues (Cilliers, 2019; Nero *et al.,* 2019).

The implementation of policies related to the green agenda in Africa despite having legislation in place is weak enforcement institutions (Nero *et al.,* 2019). This has widened the gap between the formulation and the implementation. Cilliers (2019) alludes this to a lack of commitment and political will from leaders leading to gaps in implementation. Local authorities are often not fully given support by the central government to fully function. This has been observed in Kumasi, Ghana which was once the 'garden city of West Africa' but due to institutional silos by the different levels of government, the city has lost its previous green city status as argued by Mensah (2014). However, most urban greening initiatives have been stalled by budget constraints. As alluded by Venter *et al.* (2020) by stating that due to financial and budget constraints and lack of skilled staff, it is increasingly difficult for municipalities to develop and maintain urban greening. This has been confirmed by Cilliers (2019) who asserts that the lack of skills and budget constraints have affected the implementation of green infrastructure hence contributing to challenges of attaining sustainability, though local authorities can engage in partnerships and community participation in realising the implementation of strategies and policies that enhance urban sustainability.

#### 2.4.1.5 Partnerships and Participation

Policy makers are presented with knowledge on how to solve problems that might not be easily solved using conventional methods through participation by the local stakeholders (Li *et al* 2020). In addition, public participation in decision making has been identified as a prerequisite for achieving sustainability (*ibid*). This is because of its ability to create a shared vision amongst different groups through participatory planning approaches to address and resolve conflicts leading to an improved quality of life for the community (Namatama, 2020). However, public participation in some instances can prove to be problematic and its effective attainment can be hindered by political influence, inadequate finances, and unclear motives

from some stakeholders (Suškevičs, 2019). This is because powerful and wealthier stakeholders can intimidate poorer stakeholders hence hindering them from fully participating in the decision-making process.

This study recognises that the engagement of stakeholders in the spatial planning process not only provides a way of knowledge exchange, but also provides planners with an opportunity to listen to the preferences of the stakeholders and match critical area needs of the community to development planning. This could prove vital in implementing green agenda related strategies as the community can easily advise on areas around the neighbourhoods such as ecologically sensitive areas that planners might not be aware of (Rania, 2017).

Involving the community also provides an opportunity to build partnerships with stakeholders to ensure sustainability awareness through consensus. Cordova and Stanley (2021) note how partnerships are playing a critical role in assisting local governments in sharing costs, administrative boundaries, and risk sharing. Suškevičs (2019) observe that partnerships also provide an opportunity for financial incentives and bring mutual economic benefits due to the long-term commitment from the partners. Particularly in instances where the local authorities have inadequate funds to implement a project, partnerships bridge the financial gaps. This builds social capital and potentially leads to decisions that advocate for better urban sustainability projects due to the mutual consensus of the different stakeholders.

#### 2.4.1.6 Transition to Energy Efficient Cities

Energy plays an important role in the economic development of cities and is a core component of the sustainability pillars (Yuan *et al.*, 2018). This is because all three sustainability pillars depend on energy in one way or another. However, energy production continues to pose a threat to sustainability. According to a British Petroleum (2019) report as of 2019, fossil fuels (natural gas, coal, and oil) are still highly used globally as primary sources of energy, making up 84% of global energy consumption as shown in Figure 2.3. This poses a threat to attaining sustainability in cities because the GHGs that are produced when the fossil fuels are burnt contribute to climate change as they build-up in the atmosphere (Johnsson *et al.*, 2019). Yet, spatial planning presents itself as a tool that can be used to help create low carbon cities through concepts of creating new or modifying urban forms as argued by Wang *et al*. (2018). Spatial planning can be used to modify the urban form to mitigate climate change through measures that reduce energy consumption. To achieve this, Cavoli (2021) argues that spatial planning can contribute to the reduction of energy use through the prevention of car oriented urban development by the integration of land use and transport planning. This is because car

dependent developments contribute to urban sprawl which leads to increased consumption of energy. This study proposes that this can effectively be achieved by considering the urban form and fostering sustainable mobility as this, in turn, would guide the formulation of strategies such as designs and planning that encourage the use of public transport, walking, cycling, and decreasing the use of personal vehicles. The use of public transportation systems such as the Bus Rapid Transit has been a success in cities like Curitiba in Brazil (Wang *et al*., 2018). Not only has public transportation contributed to the decrease in congestion but also reduces GHGs and made the city more liveable (*ibid*).

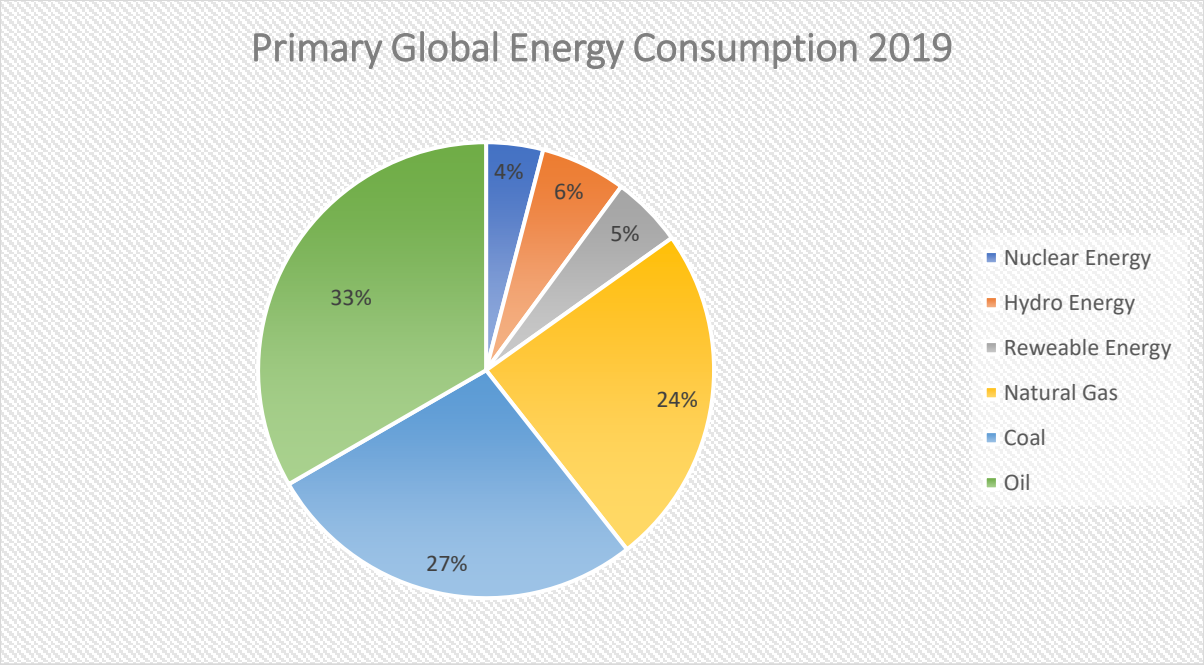



Figure 2.2 Primary Global Energy Consumption of 2019, Source: British Petroleum Review of World Energy, 2020

In addition, spatial planning has the ability of mitigating climate change through the utilisation of renewable energy and the provision of energy efficient settlements. Yuan *et al.*, (2018) note the importance of renewable energy to attain sustainable development because they are formed from sources such as water, sunlight, wind, and biomass. Spatial planning can facilitate the implantation of renewable energy technologies and infrastructure in cities through the allocation of suitable sites to support the development of renewable energy sources such as wind and solar (Wang *et al*., 2020). Though this study acclaims that it is not easy for cities to transit to renewable energy as it comes with issues of rezoning, stakeholder engagements and linking economic, social, and ecological constraints. The transition process is also coupled with configurations of service provision systems in the built environment which is a cost and

notwithstanding the complex procedure of social and institutional transformations that may not allow a smooth transition process (Huang *et al*., 2018).

Similarly, spatial planning also plays the role of mitigating GHG emissions through the allocation of land use that improves energy efficiency and protecting green infrastructure through the development of strategies that enable the implementation of local and regional plans (Stoeglehner, 2020). This includes the formulation of spatial development framework, neighbourhoods plan, building plans that adhere to and promote regulations such as energy efficiency before they are approved by the local authority (Wang *et al*., 2020).

## 2.5 Conclusion

The chapter presented on the integration of the spatial planning, green agenda to promote urban sustainability. The chapter began by mapping the timeline of sustainability. It was revealed that the concept emerged centuries back before the Brundtland Report ignited the call by linking sustainability to the environment and economic growth in cities. Due to the rise in the growth of many cities due to population and economic growth which has posed a threat to cities as observed from the fast rate of urbanisation that has contributed to climate change prompting the rise of sustainable cities in the global agenda and discourse. Placing spatial planning at the core to drive this agenda and the green agenda has positioned itself as a catalyst that can enable the preservation of cities and promote urban sustainability.

Due to the urban form of cities characterised by urban sprawl which in turn contribute to high usage of personal vehicles leading to unsustainable use of energy and emission of GHGs. Spatial planning factors such as mixed land use planning, compactness and densification, green infrastructure, transition to renewable energy were revealed to be measures that can be used to promote urban sustainability in cities. These must be coupled with an enabling environment that allows for the smooth formulation and implementation of policies. With these in place, the promotion of urban sustainability in cities is attainable.

# 3 Research Methodology

## 3.1 Introduction

This chapter aims at discussing the methods used to collect data for this research. The chapter begins by looking at the research approaches and gives details of the City of Johannesburg as the case study before the research data and data collection tools are presented. This is followed by the data analysis process that has been employed by the study. The chapter then presents the ethical considerations that have been adhered to and the limitations encountered by the study before concluding.

## 3.2 Research Approach

This study follows a qualitative method which tends to be naturalistic or constructivist paradigm where the researcher does not try to manipulate the setting of the research (Mosera and Korstjensc, 2017). It focuses on the natural setting of relationships, events, programs, and interactions that are not predetermined. Qualitative research aims to understand the natural occurrence of a phenomenon. This implies that it gives detail and depth of a phenomenon by studying its occurrence. This is done by using words to describe findings rather than numbers (Yin (2009). The qualitative approach gave me an understanding of the CoJ and how it interprets urban sustainability.

## 3.3 Case Study of the City of Johannesburg

As earlier stated, the City of Johannesburg is the case study for this research. Yin (1994:13) defines a case study as an investigation of a phenomenon in its context when the boundaries between the context and the phenomenon are not evident. In this study, the City of Johannesburg's integration of the green agenda in energy policy to promote urban sustainability is the phenomenon that is under examination. Yin (2003) affirms to this by noting that the use of the case study method allows the researcher to deliberately cover conditions that are relevant to the phenomenon of the study. In addition to this, the case study method has been argued by Yin (2009) as the best method to answer the “why”, “how” questions which were explored by this study.

The City of Johannesburg presented itself as a suitable case study of this study. This is because Johannesburg is a leading emitter of GHGs in South Africa despite the coal generation plants that generate the electricity used in the Mpumalanga Province (Akinbami, Oke, and Bodunrin,

2021). In addition, the use of motorised transport is also another contributor despite investment in public transportation models such as Bus Rapid Transit (BRT) and the Gautrain (CoJ,2018).

## 3.4 Research Data and Data Collection Tools

The relevant data for this report was gathered through a secondary data analysis which was complemented by online interviews with experts in the department of Development Planning and Environment and Infrastructure Services Department at CoJ and NERSA. I carefully analysed policies, plans and strategies such as White Paper on Renewable Energy (2003), the Johannesburg Spatial Development Framework 2040, Gauteng Transformation Modernisation and Reindustrialisation Strategy, the 25 Year Gauteng Integrated Transport Master Plan, Local Government Energy Efficiency and Renewable Energy Strategy (2014), the White Paper on Renewable Energy (2003), the Energy and Climate Change Strategy and Action Plan: Climate Change Strategic Framework for City of Johannesburg at the national, provincial and municipal level relevant to the research and used them as units of analysis as shown in table 3.1. Since this report is dependent on secondary data, primary data was collected to fill in the gaps identified in the policy analysis.

### 3.4.1 Policies Related to Urban Sustainability

This section will first start by listing policies that this study reviewed to arrive at its analysis as shown in table 4.1. Some of these policies, strategies and plans which are relevant to the study are shown below.

*Table 3.1 Showing Policies, Plans and Strategies*

| | **POLICIES, PLANS AND STRATEGIES AT NATIONAL, PROVINCIAL AND LOCAL LEVEL** |
|---|---|
| | South African Constitution of 1996 |
| | The White Paper on Renewable Energy (2003) |
| | National Development Plan 2030 |
| | National Climate Change Response Policy White Paper of 2011 (NCCRP |
| | National Strategy for Sustainable Development and Action Plan |
| | Local Government Energy Efficiency and Renewable Energy Strategy (SALGA |
| | National Energy Efficiency Strategy (2011) |

| | |
|---|---|
| | The Gauteng Integrated Energy Strategy |
| | 25 Year Gauteng Integrated Transport Master Plan |
| | Gauteng Environmental Management Framework |
| | Gauteng Transformation Modernisation and Reindustrialisation Strategy |
| | Green Infrastructure Strategy for Johannesburg |
| | Energy and Climate Change Strategy and Action Plan: Climate Change Strategic Framework for City of Johannesburg |
| | Johannesburg Spatial Development Framework 2040 |
| | Joburg 2040: Growth and Development Strategy |
| | City of Johannesburg Integrated Development Plan |

### 3.4.2 Demographics

The sample size consisted of four participants who were selected purposively. Purposive sampling is a non-probability selection where participants are selected deliberately (Campbell *et al.*, 2020). The participants were chosen based on the information, experience, and knowledge that they possess as shown in table 3.1. There were three participants from the CoJ. Two were experts from the Department of Development Planning who oversee policy creation, review and implementation and have been with the department for more than three years and the expert from the Environment and Infrastructure Services Department oversees policies and strategies concerning energy and has been in the department for thirteen years. From NERSA, I interviewed an expert in the Communications Department who has been with the institution for five years. The questions that were asked to the participants were structured thematically. An interview schedule was issued to the participants using Google Forms to obtain the information. I further had online meetings with the participants to probe on responses that I felt needed more explanation. The online interview schedules have been attached as Appendix three to this report.

*Table 3.2 Showing the demographics of the participants*

| **Name** | **Department** | **Years in the Department** | **Role** |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Dlamini* | Department of Development Planning of CoJ | 3 | Oversees spatial planning policy creation, review, and implementation. |
| Nkosi | Department of Development Planning of CoJ | 4 | Provide strategic policy guidance |
| Buyanda* | Environment and Infrastructure Services Department of CoJ | 13 | Superintends the regulation of city power, ensuring that the policies of the City are implemented.<br>Oversees all energy resources of the City. |
| Mtosi* | Communication Department of NERSA | 5 | Communicates decisions of the Energy Regulator to the public and other stakeholders. |

## 3.5 Data Analysis Process

A qualitative data analysis deals with data presented as words, pie charts, bar charts (Sarantakos, 2015). Many scholars have argued that there is no uniform process which qualitative analysis should take. This is because there are many rigorous ways in which qualitative data can be analysed. This makes the analysis process more in-depth, detailed, and focused than quantitative analysis. Sarantakos (2015) states that data analysis in a qualitative study usually starts from data collection because as one collects, they notice occurring themes.

Due to the nature of this study, I undertook a secondary data analysis to analyse the data. To guide the analysis, themes which include green agenda, spatial planning, and energy efficiency were used to guide. The themes were inspired by the research questions. To collect relevant data, I used Google to search and select the relevant data that related to the themes of this research. After downloading the relevant documents, I read and evaluated the data. Through the evaluation, I was able to select and extract what I deemed necessary and saved the information using Microsoft Office software. The data collected during the interviews was also organised and saved using Microsoft Office. This data was then organised using common

perspectives which is suitable for open ended questions like the ones used for the interviews (Creswell, 2012). This offered me flexibility in the analysis process because it was easy to organise and analyse the data by labelling it according to the theme.

For the analysis process, I familiarised myself with the data that I collected through reading the extracts and responses. I assigned different tags to the data to help me in classifying the themes. The next step undertaken in the analysis was interpreting and sorting the data according to overarching themes. This was followed by reviewing the themes, here some themes were refined, combined and others discarded to allow cohering the themes. Then the themes were defined and refined, this led to formulation of sub-themes within the data. Then finally the analysis was interpretated into a write up. The figure below shows the steps undertaken in the analysis as adapted from Braun and Clarke (2006).

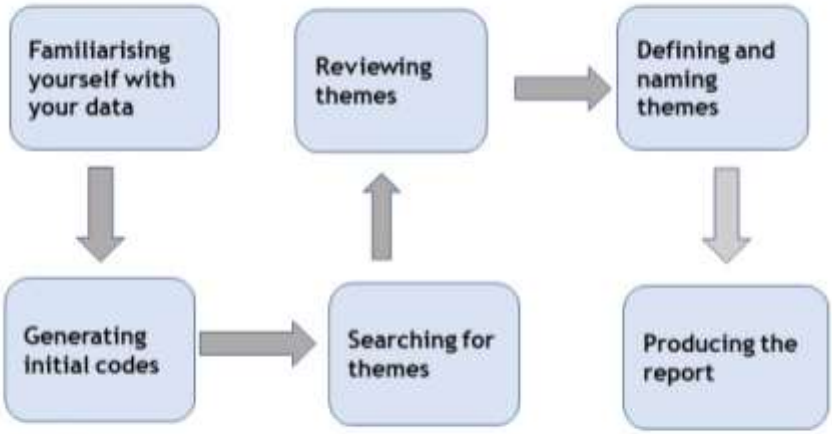



Figure 3.1 Data Analysis Steps. Source: Adapted from Braun and Clarke (2006)

## 3.6 Limitations of the Study

Due to the COVID-19 pandemic, some measures had to be taken during the data collection process. Owing to the severity of the pandemic, South Africa went into lockdown in March 2020. By the time I was conducting my data collection, the enforcement of the lockdown was still in effect and the ethical considerations by the University of the Witwatersrand did not permit students to conduct physical interviews. To this regard, I had to issue a survey using Google Forms, followed by an interview schedule to probe further where I needed clarity using an online platform, Microsoft Teams.

The other limit was that the participants were reluctant to take part in the study; this made it difficult to collect data. Some participants could not avail some of the policies used by their departments that could have been useful for this study such as the Green Building Policy.

## 3.7 Conclusion

This chapter began by giving the research approach that was utilised in this study. Due to the nature of the research questions (how, what), the case study method was adopted. To this regard, the City of Johannesburg was chosen as a suitable case study for this research, considering the inequality and fragmentation of its urban form which has contributed to high emission of GHGs due to high energy use that arises from electricity consumption and transport systems. Further, Johannesburg has been considered because of its economic status as an African powerhouse that has a lot of economic activities which are a pull factor for migrants from within South Africa and from the rest of Africa. To achieve the objective of the study, I reviewed policies and strategies that deal with energy and urban sustainability. In addition, an interview schedule was administered online to the participants. Purposive sampling which involves the deliberate selection of participants was used to select the interviewees for the study. Officials from the City of Johannesburg and National Energy Regulator of South Africa were interviewed to fill in the gaps identified in the policies. The following chapter will discuss in detail the findings and analysis of the integration of the green agenda.

# 4 The Role of the Green Agenda in Promoting Urban Sustainability

## 4.1 Introduction

This research sought to find out if the green agenda is being integrated in energy policy to promote urban sustainability. This chapter presents the finding and analysis based on what was pointed out in the previous chapters about the unequal and fragmented urban form of Johannesburg due to the inherited legacies of apartheid. It was also revealed that spatial planning plays an important role of promoting urban sustainability through strategies such as mixed use, compaction, densification and efficient policy formulation and implementation. To this regard, this chapter discusses the research findings and analysis specifically the existing measures and strategies that the City of Johannesburg has currently put in place to promote urban sustainability. The chapter will give an understanding of the gaps that may exist in promoting urban sustainability through integrating the green agenda. This chapter will focus on the policies, and spatial planning as a tool to achieving sustainability before concluding

## 4.2 Mainstreaming the Green Agenda Strategies in Johannesburg

The rapid decline in resources and degradation of the environment which has been caused by among other things the urban form and rise in population has prompted governments to take action to preserve cities (Gao and Zhang (2020). To this effect, as observed in literature, globally, cities are engaging in different measures in which they can incorporate the green agenda to reduce the negative environmental impacts. The City of Johannesburg is no exemption. Below, the measures that have been put in place to promote urban sustainability in the city will be discussed in detail.

### 4.2.1 Understanding the Green Agenda

The participants that took part in the study gave their understanding of the green agenda. The participants from the Department of Development Planning gave two responses. Ms Nkosi defined the green agenda as *"a spatial form that advocates for efficient use of resources with consideration of improving lives for all members of the community."* on the other hand, Ms. Dlamini' s definition was *"that which is concerned about improving the way in which we go about business, building cities that are resilient to socio-economic and environmental challenges. For instance, the shift to low carbon public transport options or off the grid power supply".* From the definitions given by the participants from the Department of Development Planning, it can be deduced that they based their definition of the green agenda to spatial

planning and its role of ensuring sustainable cities. This is also based on the objectives of the Johannesburg Spatial Development Plan 2040 whose aim is to create a compact polycentric city.

The Environment and Infrastructure Services Department defines the green agenda as "*livability, resilience, sustainability and the economy that supports low carbon infrastructure*". This definition is referenced to the second expected outcome of the Johannesburg 2040 Growth Strategy (CoJ: 2011:9) which states, "provide a resilient, livable, sustainable, urban environment underpinned by infrastructure support of a low carbon economy". The City's view is to establish sustainable solutions in infrastructure such as energy, water, sanitation, housing, and mobility. The idea is for the sectors mentioned above to transition to a green economy by minimising waste generated, diversifying the energy mix to clean energy and efficient use of scarce resources. The department is in the process of formulating the Energy Plan whose focus is to have a Johannesburg that uses 50% renewable energy by 2050 and for City Power (an entity of CoJ) to be an independent energy producer.

Meanwhile, according to the participant from the National Energy Regulator of South Africa, the definition of the green agenda is "*having a mixed energy generation technology that includes renewable energy*". This definition is primarily concerned with having a diverse energy mix that considers both non-renewable and renewable resources. This is particularly important for the green agenda because renewable energy sources are naturally capable of replenishing themselves and are environmentally friendly. The main reference policy for the National Energy Regulator of South Africa is the White Paper on Renewable Energy of 2003.

The findings depict that different departments relate the green agenda to the work they execute. As observed, all participants gave a definition based on the mandate of their departments.

## 4.3 Towards a Spatially Just City

Spatial planning was regarded in literature as a driver of attaining urban sustainability. It was also revealed in literature by Shackleton and Gwedla (2021) that Johannesburg has an unequal and fragmented urban form which was inherited from the apartheid system. In the findings, it was revealed that Johannesburg has unequal and fragmented urban form which is being addressed in the in Spatial Development Framework 2040. The Spatial Development Framework 2040 is its guiding tool for spatial transformation in the city. The Johannesburg Spatial Development Framework 2040 was adopted by the Johannesburg Council in 2016 to direct the development and land use in the city. It seeks to address spatial and social issues of

"increasing pressure on the natural environment and green infrastructure, urban sprawl and fragmentation, spatial inequalities and the job-housing mismatch, exclusion and disconnection emanating from, high potential underused areas and inefficient residential densities and land use diversity" (CoJ, 2016:11).

The aim of the policy is to facilitate a world class African city through the principles of justice, equity, resilience, sustainability, and urban efficiency(*ibid*). These principles translate to a compact polycentric city whose growth is in a compact manner defined by transformation and transit-oriented development nodes. Amongst the features that the city is using to achieve a compact polycentric city is transit-oriented development and public transport corridors riding on the 'Corridors of Freedom' whose implementation commenced in 2013.

### 4.3.1 Fostering Sustainability, Efficiency, and Inclusiveness through Compaction

The fragmentation and inequalities in the urban form of Johannesburg were prominent in the literature reviewed, the interviews with the participants confirmed these assertions discussed in the literature. Johannesburg is spatially unequal and fragmented as was stated by Shackleton and Gwedla (2021). The City has a mismatch between where people live and where they work. This is because of the legacies of apartheid where races apart from the white race were segregated and lived far from where economic activities took place. This is still the case as people still travel long distances to access economic activities as stated by Nkosi (Personal Communication, 2021).

> *"Johannesburg has a mismatch in how the settlement and places of employment are located which can be traced from the apartheid system. This mismatch has resulted in people traveling long distances from their homes to their places work."*
>
> Nkosi, personal communication, 2021.

However, these issues are now being addressed by CoJ through the SDF 2040 which aims at integrating the green agenda by creating a polycentric compact city using the Corridors of Freedom. This has been done through the transit-oriented development which focuses on intensifying development around public transport systems to encourage mixed use, densification, and high-quality environment (CoJ, 2016). The intention is to create a proximity of economic activities and public transit transport systems. This is being done by physically connecting nodes such as Soweto, the Inner City, Alexandra, Sandton. The purpose is to foster

compactness through the provision of public transport and economic activities around these nodes.

In addition, the corridors are characterised with mixed land use such as high-density buildings, schools, parks, public square, clinics, housing, and offices. The idea of the Corridors of Freedom is for residents of the city to live close to their places of work hence they will be able to walk to work or use public transport and not use private transportation. Thus, this will address the issues of urban sprawl in the city through densification and closeness in proximity to economic activities (Nkosi, Personal Communication, 2021). This is the confirmation from the literature review where Bibri, (2020) and Iizuka *et al.* (2020) stated that compact cities reduce car dependence due to the proximity of various land use.

Based on the findings, this study established that corridor related investments have been mostly in the wealthy northern parts of the city whereas the poor areas that were intended to attract investments in the corridor attract limited niche investment (Nkosi, personal communication, 2021). Hence the corridors have not really transformed the urban form as was anticipated because the investments are still in the wealthy neighbourhoods. Also, according to Nkosi (personal communication, 2021) the spatial transformation that has been witnessed in the poorer parts of Johannesburg is mostly informal with mushrooming of backyard housing rather than the corridor type of development that was initially envisioned.

Further, this study through the literature reviewed and analysed established that having the Corridors of Freedom in place facilitates dentification because residents don't have to travel all the way to the central business district to acquire services because services are now within their proximity. This helps in the attainment of urban sustainability because of the reduction in the use of private vehicles which leads to a reduction in GHGs that are emitted by vehicles. However, the city is still struggling with GHGs as the 2018/2019 Johannesburg Integrated Development Plan places transport sector as the 2$^{nd}$ leading contributor to GHGs emissions in Johannesburg. But this is because the routes earmarked for public transportation in the Corridors of Freedom are not all fully operational.

### 4.3.2 Integrating Land Use and Transportation

As part of creating a sustainable city, the City of Johannesburg has its primary focus on creating affordable, sustainable, and efficient public transport systems as stated in the SDF 2040 (CoJ, 2016). This is also part of the regional objective as per the Gauteng Transformation, Modernisation and Reindustrialisation Strategy which has modernisation of public transport

systems and placing the development of corridors as part of the strategies of achieving its objectives. In addition, the 25 Year Gauteng Integrated Transport Master Plan's focus is to have a transport network system that is competitive, responsive, and efficient that priorities public transport. The plan has focus areas of spatial development and environmental soundness, economic development, and the effective public transport system as core areas of concern. These goals have been embodied in the Johannesburg Spatial Development Framework 2040 which states that among the aims of formulating the Corridors of Freedom is the need to connect different nodes around the city through public transport systems as an integral part of the compact polycentric model of the city. The aim is for the corridors to support the notion of the compact city through the creation of sustainable communities that have mixed use high-density urban areas that have an efficient public transport system.

In the findings of this study based on the literature reviewed, it was revealed that the Bus Rapid Transit and the Gautrain are part of the investment in public transportation. The Gautrain connects the city centre through nodes in the east and north such as Rosebank, Sandton, Midrand, OR Tambo Airport through to Pretoria. While the Bus Transit Rapid despite being operational has routes that are still under construction. Of the routes that have been completed, the first route runs from Soweto through Auckland Park to the CBD, while the second phase rans from Cresta, Windsor West, Parktown to Yeoville. Currently, the Phase C which is 90% complete is set to run from Parktown to Alexandra then Sandton (Nkosi, personal communication, 2021).

All these were implemented as part of expanding public transport systems and to replace the taxis with the BRT system which uses alternative cleaner fuel contributing to a reduction in GHGs emission in the city. The initial plan was to engage minibus taxis to hand over their vehicles with a grant to have shares in the BRT system. However, this has not been easy as established by this study. The current public transport system has challenges. For example, the BRT has been able to provide safe and reliable transport options for commuters in historically disadvantaged areas such as Soweto but is also viewed as expensive compared to minibus taxis as reported by Harrison, *et al*. (2019) in their findings. Also, it has not been fully accepted by

the Taxi Industry who have complained about the loss of revenue for taxi owners as was noted by Ms Nkosi.

> *"The Municipality has had challenges in the implementation of the BRT because the taxi owners who the municipality intended to be stakeholders in the Rea Vaya have been resistant by complaining that they have lost their revenue due to the introduction of the BRT."*
>
> Nkosi, personal communication, 2021.

Further, the Gautrain is more of an elite and costly option and does not cater for the transport needs of the majority population. This is also confirmed with the routes taken by the train which are on the 'northern wealthy suburbs' of the city. This defeats the aim of inclusion which the City has been trying to address. However, Nkosi (personal communication, 2021) stated that plans are in place to extend the Gautrain routes to the south side of the city.

### 4.3.3 Political Interventions in achieving a Sustainable City

Despite the Corridors of Freedom promising densification and compaction in Johannesburg, its implementation has not been as expected because of various challenges. According to Nkosi (personal communication, 2021) the project was first launched under the African Nation Congress led Council in 2013, however, with the Democratic Alliance coming into power in 2016, there was a reduction in the capital budget towards the Corridors of Freedom. Although, in 2019, the Council was again under the ANC leadership, no clear indication was made regarding the continuation of the policy and implementation has been lagging in the past few years as noted by Nkosi (personal communication, 2021). This confirms what was stated in literature by Cilliers (2019) and Nero *et al.* (2019) how priority by politicians affects the implementation of various programs and strategies.

The Corridors of Freedom is a good strategy to promote sustainability in Johannesburg through densification and compaction and encouragement of the use of public transport system, which was stated by Bibri, (2020) in literature as a spatial planning measure that promotes urban sustainability. However, the impediment in its implementation has left some gaps in fulfilling the objectives set to be achieved. This also affects the aims that the City intended to achieve as shown in figure 4.1 which shows the transformation from a polycentric city which the SDF states as "an urban structure that is characterised by more than one self-sufficient urban centre that are interconnected by transit links"(CoJ, 2016:6) to a compact polycentric city which is

stated to be “an urban structure that is characterized by a dense urban core interlinked by efficient transit networks to dense complementary sub-centres”(CoJ, 2016:5) . This implies that the inner city will be the core node which will be surrounded by mixed use nodes which are connected by public transportation.

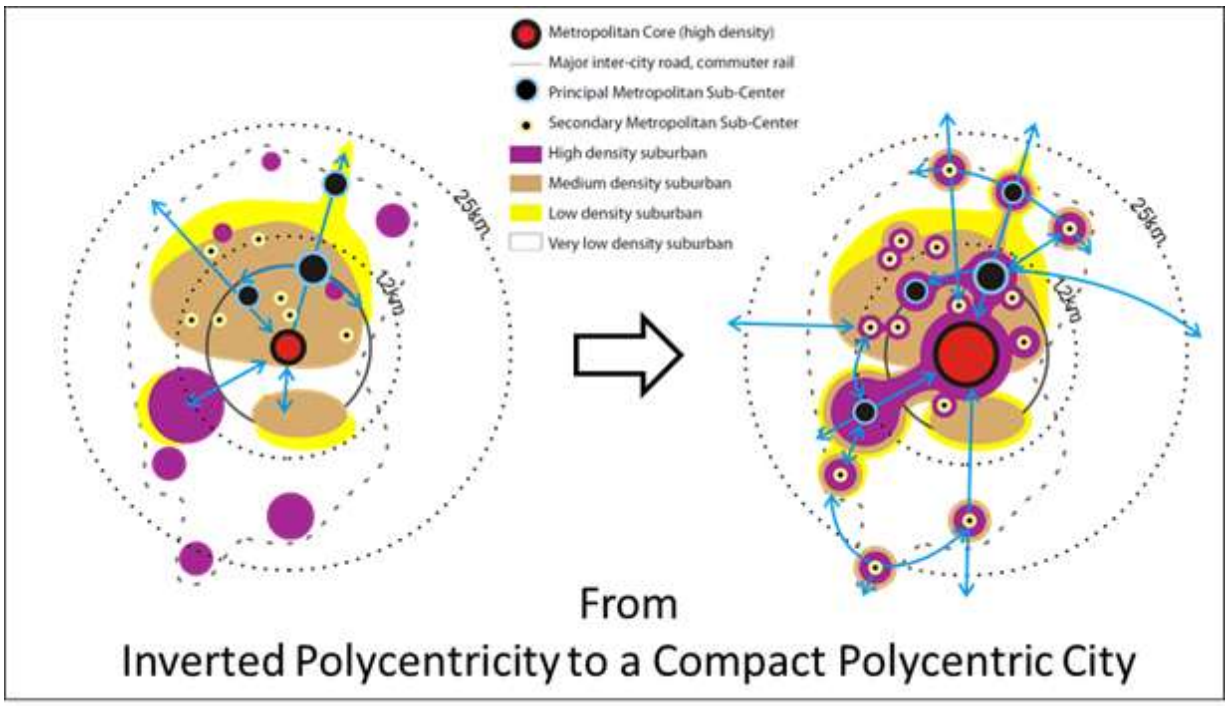



Figure 4.1 showing the transformation of Johannesburg from a Polycentricity to a Compact Polycentric City. Source: COJ (2016: 70).

### 4.3.4 Transiting to Energy Efficient Buildings

During the review of policies used for this research, it was revealed that in 2011 the South African Government amended the National Building Regulations and Building Standards Act of 1977 to include a chapter (SANS 10400-XA 2011) which focuses on sustainability. The amendments require that new or old buildings that require renovation, whether residential or commercial must be energy efficient by considering water heating and insulation before they are approved by municipalities. The City of Johannesburg has taken this further exploring the Net-Zero Energy Building policy which focuses on energy efficiency interventions.

In addition, at city level, Ms. Dlamini (personal communication, 2020) also explained that the City of Johannesburg is currently formulating the Green Building Policy for the City. The aims of this policy are to have designs, developments and operational practices that significantly reduce the negative impacts that are caused by development projects on the environment and humans. Ms Dlamini could not avail the draft Green Building Policy to me at the time of the

interview because it was not yet for public view. However, based on the findings on national level, the analysis is that just as emphasized in literature by Wang *et al*. (2020) states spatial planning can promote urban sustainability through approving building and neighbourhood plans that adhere to energy efficiency. This is the case with the City of Johannesburg who enforce the National Building Regulation and Building Standards Act to ensure that buildings are energy efficient, hence promoting urban sustainability. It was also impressive that the City of Johannesburg has explored the Net-Zero Energy policy despite absence of national level requirement to this effect. This shows the City's effort in ensuring urban sustainability.

### 4.3.5 Nurturing Green Infrastructure

As observed from the literature review, green infrastructure is a vital component of spatial planning to promote urban sustainability. This is because of the role it plays in urban sustainability by mitigating the risk associated with climate change. Likewise, based on this study's review of policies, it was revealed that the CoJ made some considerable progress in integrating the green agenda through having a Climate Change Adaptation Strategy and has engaged the Gauteng City-Region Observatory to develop a Green Infrastructure Strategy for the city. In its Climate Change Adaptation Strategy, the City hopes to "define and prioritise the key environmental sustainability issues facing the CoJ, develop understanding of the drivers of the current situation, and unpack the implications of the status quo for the well-being of citizens and the economy, with the intention to lay the foreground towards a sustainable city" (CoJ:2019:3). In this regard, green infrastructure has been placed as one way the city will achieve its objective. Although, from the findings, Ms Dlamini is of the opinion that the city was not doing enough to achieve this by stating that;

> *"the problem is that issues of green infrastructure are not prioritised compared to other social services such as water and sanitation, health, housing, or education. The politicians feel like if they do not prioritise these social issues, they will lose votes. So, most policies concerned with green infrastructure are not considered and are viewed as a luxury which is mostly found in northern Johannesburg"*
>
> Dlamini (personal communication, 2020)

This confirms what was revealed by Cilliers (2019) in the literature review that green infrastructure is not given priority in the City. Similarly, Shackleton *et al.* (2018) revealed that green infrastructure was unequally distributed with the historically wealthy northern suburbs having denser tree coverage than the poor southern parts of the city as depicted by figure 4.2 obtained from Schäffler and Swilling (2013) citing GCRO.

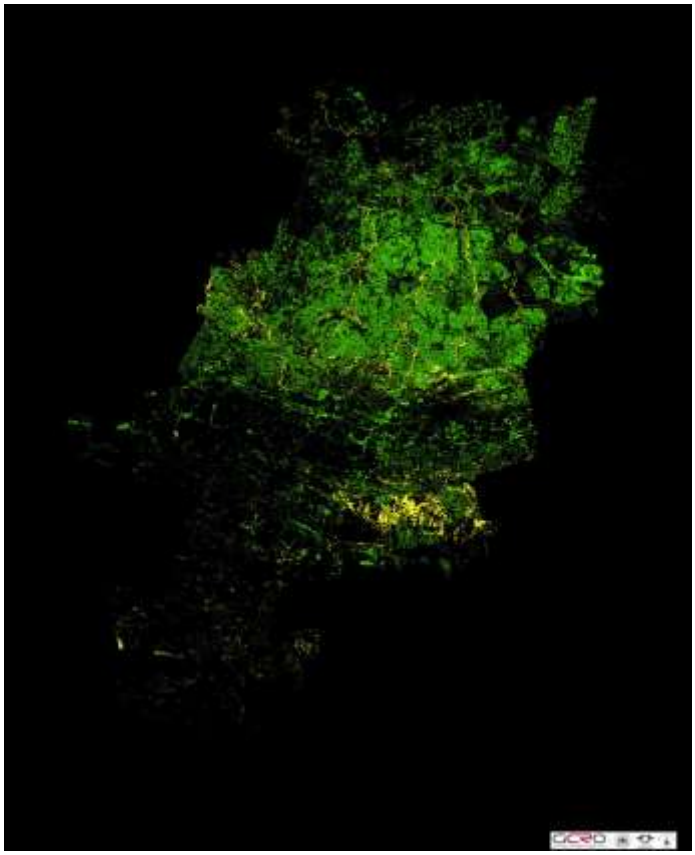


Figure 4.2 Map of Green Infrastructure distribution in Johannesburg Source: Schäffler and Swilling (2013:251) citing GCRO, 2010

When probed further, Ms. Dlamini gave an insight on why this was the case. She stated that,

> *"You know, apartheid is still felt in Johannesburg. The northern parts of the city have always had rich people who are able to employ people from the South to take care of their gardens but in the South, people are mostly unemployed and poor, and they prefer other social services like water and housing and the politicians capitalise on this because the south has more voters."*
> Dlamini (personal communication, 2020)

This validates what was revealed in the literature by Pasquini and Enqvist (2019) and Shackleton *et al*. (2018) about the uneven distribution of green infrastructure between the poorer and richer areas of Johannesburg. However, Dlamini (personal communication) stated that the Green Infrastructure Strategy that the City is formulating aims to resolve some of these issues being faced by using spatial planning as a tool to harness opportunities for grey-green infrastructure solutions and ensuring that plans and designs reflect green measures. To establish my analysis, I took interest to compare a wealthy suburb and a poor township. I compared Greenside (Figure 4.3) and Alexandra Township (Figure 4.4) using Google Earth. It was established that streets of Greenside were heavily surrounded by green infrastructure in the form of trees and green open spaces while I could count the number of trees in the streets of Alexandra. This confirmed the unequal distribution of green infrastructure in and around Johannesburg and the need to intensify the reconciliation of this ecological inequality. Another finding was that the southern parts of the city such as Soweto have high unemployment levels and are densely populated as shown in Figure 4.5. This was linked to the functions of green infrastructure and translated to how the richer suburbs had better air filtration, cooler summers, and less noise pollution while the poorer neighbours endured hardships and stress of heat coupled with the dense population. This confirms that the apartheid legacies of inequalities are still manifesting in the city.


Figure 4.3 A Google Earth Image of Greenside, a wealthy suburb in Johannesburg showing the intensified green infrastructure around it. Source: Google Earth,2021


Figure 4.4 A Google Image of Alexandra, a low-income township in Johannesburg, showing minimal green infrastructure. Source: Google Earth, 2021

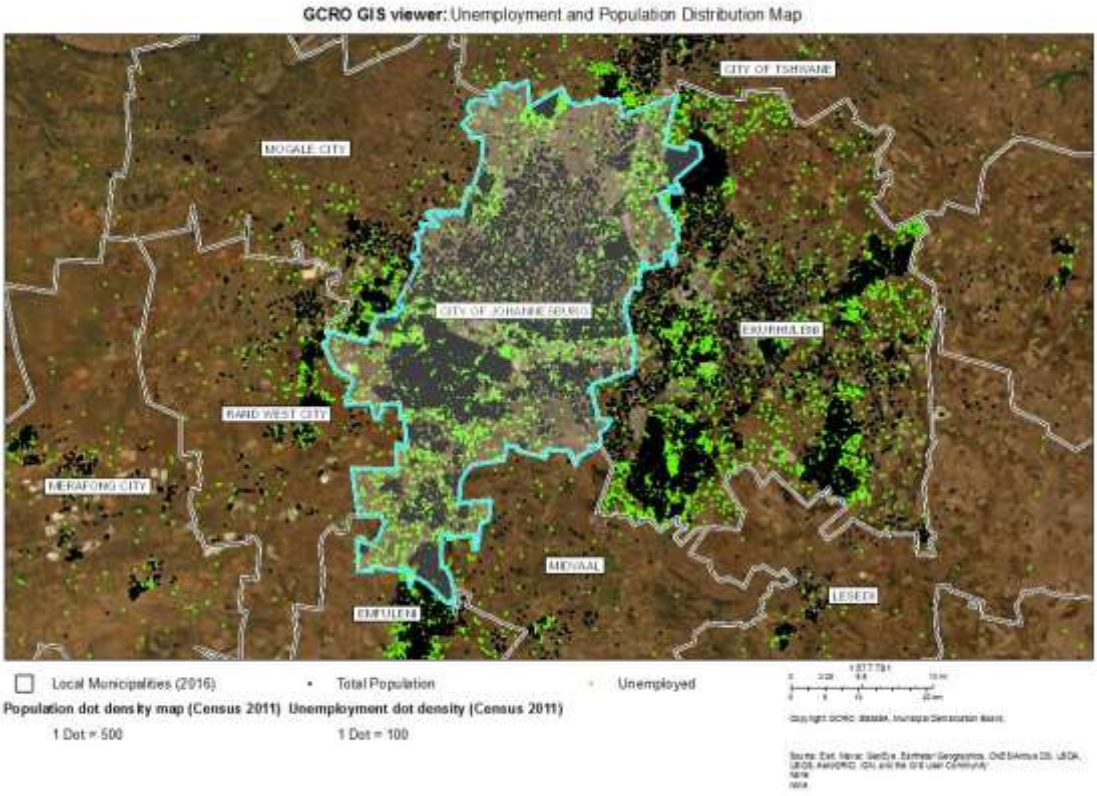



*Figure 4.5 Unemployment and Population in Johannesburg. Source: GCRO, 2020*

The above findings confirm what was stated in literature by Makakavhule and Landman (2020) that the legacies of the inequalities of apartheid are still visible in the city as observed from the images. The high population density and high unemployment confirms that the urban form is still uneven because the areas that were previously disadvantaged during apartheid are still disadvantaged as observed with the high unemployment levels. However, these are the issues that the 2040 Johannesburg SDF is trying to address.

## 4.4 Transiting to Renewable Energy to Promote Sustainability

As stated in literature, energy is an important component of sustainability although its production using fossil fuel continues to pose a threat to sustainability. (Johnsson *et al.*, 2019). Also, it was stated that transiting to renewable energy was one-way in which the green agenda can be used in spatial planning to achieve sustainability (Cavoli, 2021). This study established in its policy review that the City of Johannesburg's role in transiting to renewable energy has been stirred by the national government who proposed changes to energy production in 1998. This was done by formulating the White Paper on Energy Policy. This is found under Page 14 *Part Three: Supply Sector and subsection 3.4.7 Renewable Energy* of the White Paper on

Energy Policy proposes some changes to energy production. The government pledged its effort to promoting the sustainable production and management of renewable energy systems such as solar heaters, solar heating systems and solar water pumps (Department of Minerals and Energy, 1998) although, the most significant turning point in renewable energy policy in South Africa was in 2003 when the government formulated the White Paper on Renewable Energy. In this policy under the Deputy Ministers Foreword, he stated that *"…. Government is setting as its target 10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydr*o." (Department of Minerals and Energy, 1998: i).

Meanwhile at the local level, the City of Johannesburg is in the process of developing an Energy Plan. The Plan aims to transit the Johannesburg economy from a coal dominated to one that is dependent on renewable sources aligning with the national objectives of transiting to renewable energy.

> *"…we aim to transit to 50% renewable energy as a City by 2050 and turn City Power into an energy company to reduce reliance on Eskom."*
>
> Buyanda, personal communication, 2020.

This study established that indeed the City of Johannesburg is emulating the national government in advancing renewable energy transition. In the interviews conducted and policy reviewed it was established that one strategy that was formulated to promote renewable energy is the solar water heater program (SWHP). This program was formulated to decrease dependency on coal and offset electricity bills related to water heating at national level (Eskom, 2017). The City has implemented this program through its entity City Power by independently rolling out and launching the Solar Water Heater Program shown in Figure 4.1. This was after the City's failure to acquire funds from the Department of Energy (DoE) (Buyanda, personal communication, 2020). The city targeted to reach 110, 000 houses in three years in Johannesburg although currently the status of the programme as stated by Mr Buyanda is that,

*"Currently the program has reached 135,000 of the 1, 432, 856 households in Johannesburg. The slow implementation of the program has been affected by budget constraints thus we only provide SWH for free to social and low-cost houses while the other members of the public who wish to have a SWH installed incur the cost"*

Buyanda, personal communication, 2020.


Figure 4.6 An example of a Solar Water Heater provided by City Power. Source: Authors Own, 2020

This study established that through this program the green agenda is being integrated and offering the city benefits in all three dimensions of sustainability. Environmentally, the benefits include the reduction of GHGs emissions in Johannesburg because heating of water is done by the SWH which are not dependent on the coal generated electricity supplied by Eskom. On the social front, residents who previously did not have hot water now have. This is vital to achieving sustainability because citizens are given equal opportunity despite their social status. There has also been a reduction in the loss of energy through transmission and distribution (Eskom, 2017). Economically, not only has it created employment for those involved in the manufacturing and installation hence providing the benefits of partnerships as stated by Li *et al.* (2020) in the literature review, but also reduced electricity bills of residents according to Mr Buyanda.

Further, another interesting finding was that the City is also encouraging the use of energy efficient equipment. For example, Mr Buyanda indicated that CoJ uses energy efficient lighting in all its facilities such as streetlights. Mr Buyanda also acknowledged that the City has not had it easy because most energy efficient equipment like streetlights in public facilities such as parks have been subjected to theft. He gave an example of how most of the solar traffic lights were subjected to theft especially in poorer neighbourhoods. This could be linked to the inequalities that Johannesburg faces. This was confirmed by Shackleton *et al.* (2018) who noticed that legacies of apartheid which had a psychological impact on residents are still evident in the behaviour of some residents who still feel disadvantaged hence they don't welcome most developments. This study deduced that such challenges are hindering the integration of the green agenda to achieve urban sustainability in Johannesburg.

## 4.5 Enhancing the Green Agenda through Partnerships and Participation

Participation and partnerships are instrumental in ensuring that the interests and priorities of different stakeholders are reflected as stated by Namatama (2020). The interviews and the literature reviewed by this study revealed that CoJ has entered into some partnerships to enhance the green agenda. One such partnership is with investors to implement the Joburg Waste to Energy Offset Project as discussed below.

### 4.5.1 Joburg Waste to Energy Offset Project

The City of Johannesburg through its waste management entity, Pikitup is undertaking a waste to energy project. The project's objective is to turn solid waste into energy considering the amount of solid waste that is generated in the city annually which is estimated to be over two million tonnes (Ndlangamandla, 2017). This project aims at using methane gas produced from waste by bacteria and turns it into energy. The City of Johannesburg partnered with several investors to come up with the project as a way of promoting the green agenda. As part of the implementation plans of the project, methane is collected from landfills in the city and turned into electricity. Currently the project generates 1.1 MW of electricity which is supplied to the Northern Water Treatment Plant (Sustainia, 2018).

The literature reviewed established how partnerships are important in promoting the green agenda in local authorities as they do not only offer collaboration with other stakeholders but also offer financial relief with mutual economic benefits in cases where a local authority finances to implement projects as indicated by Suškevičs (2019). Further, it was revealed that partnerships also create a platform for shifts in viewpoints due to the shared knowledge among

the partners. Based on these findings, it can be established that through the Waste to Energy Offset project, the CoJ is capitalising on partnerships to promote the green agenda. This has benefited the CoJ through financial, technical capacity building and knowledge.

> *"The project is important to the City because it is contributing to our target of 50% renewable energy by 2050 and it has benefited our members of staff in capacity building and new techniques."*
>
> Buyanda (personal communication, 2020)

In line with this study, this project has demonstrated that public-private partnerships are essential in realising urban sustainability because they offer responsibility and risk-sharing between the partners. Where one party lacks, the other comes through, like in this instance the City has been hindered by budget constraints however, the investors who have partnered with the City have taken up the financing and operating of the project. Therefore, proving that municipalities can execute projects that are beyond their financial capacity with the aid of partnerships to enhance development.

## 4.6 Conclusion

This chapter presented the findings and analysis of how the green agenda is being integrated in energy policy formulation to promote urban sustainability in Johannesburg. Spatial planning came out as a main strategy of how this is being achieved. It was revealed that the City formulated the Spatial Development Framework that is addressing the legacies of apartheid by fostering a compact polycentric city which aims to foster a spatially just city. In doing so, the green agenda has been integrated through the use the Corridors of Freedom which uses transit-oriented development that focuses on intensifying development along public transport systems to encourage mixed use, densification, and high-quality environment. Further, the Corridors of Freedom policy also aims at connecting different nodes around the city through accessible-to-public-transport systems as an integral part of the compact polycentric model of the city. This allows for the promotion of urban sustainability because of the reduced reliance on private automobiles due to the increase in public transportation. In addition, due to the closeness in proximity, residents can easily access different economic activities.

The City also has other ways in which it is using spatial planning to promote urban sustainability such as the use of green infrastructure, which was revealed in the findings to be unequally distributed. However, this is being addressed by the formulation of different strategies such as the Green Infrastructure Strategy. Also, the City has also adopted the National Building Regulation and Building Standards Act of 1977 amendments which requires that new or old buildings that require renovation, whether residential or commercial must be energy efficient by considering water heating and insulation before they are approved by municipalities.

Despite these and many other policies, plans and strategies formulated by the City, it is still struggling with challenges to attain urban sustainability due to among others political interferences, legacies of apartheid which have contributed to the unequal and fragmented urban form of the city.

# 5 Conclusion and Recommendations

## 5.1 Introduction

This research had a broad aim of generating a better understanding of how the green agenda is being integrated in energy policy to promote urban sustainability. It presented a case study of the City of Johannesburg as a research strategy of contextualising the issues related to energy and urban sustainability. This called for identifying the gaps and links of how the green agenda can play a role in urban sustainability for a city like Johannesburg which has an uneven and fragmented urban form inherited from the apartheid system. This final chapter draws and summarises the key findings derived from the research and provides answers to the main research question and sub-questions of the study. It further identifies and provides the implication of the study to urban management, suggests further areas of research and possible recommendations.

## 5.2 Summary of Key Findings

### 5.2.1 How is the green agenda being integrated in Johannesburg to promote urban sustainability?

The main question that was under investigation for this study related to how the green agenda is being integrated in energy policy to promote urban sustainability. Based on the policies I reviewed, and the interviews conducted for this study, the most prominent response concerning this question was the use of spatial planning and its strategies such as densification, compaction, mixed land use, building orientation and green infrastructure. These are viewed as means in which the green agenda is promoting urban sustainability.

The other response was the transition to renewable energy because of its benefit to the environment, availability (due to variety such as solar) and the energy security it offers.

## 5.3 Sub-Questions

### 5.3.1 What is the role of spatial planning in promoting urban sustainability in Johannesburg?

Spatial Planning is multifunctional because it can act as equilibrium among the different dimensions of sustainability. It can utilise different resources in a manner that the needs of the present generation are met without compromising future generation. In this regard, the City of Johannesburg has used spatial planning to promote urban sustainability through densification, compaction, mixed land use by formulating the Johannesburg Spatial Development Plan 2040 which aims to create a compact polycentric city. This is being done using the Corridors of

Freedom which focuses on transit-oriented development whose aim is to intensify development around public transport to encourage mixed use, densification, and compaction with the intention of creating close proximity to different economic activities. By having this in place, residents will be encouraged to walk because different land uses are within proximity, and further there is an encouragement to use public transport hence a reduction in the use of private vehicles and a reduction in the emission of GHGs.

In addition, the City implements the amended National Building Regulation and Building Standards Act of 1977 chapter (SANS 10400-XA 2011) which focuses on sustainability. This is done by demanding all new or old buildings that require renovation, whether residential or commercial to be energy efficient by considering water heating and insulation before they are approved by municipalities. The City has also further explored the Net-Zero Energy Building policy which focus on energy efficiency interventions and is currently formulating the Green Building Policy for the City which aims for development practices and designs to reduce on negative impact to the environment

### 5.3.2 What legislation and policy in the energy sector are directed towards promoting urban sustainability in Johannesburg?

There are several policies and legislation that are directed towards promoting urban sustainability in the energy sector however the White Paper on Renewable Energy stands out because it was the turning point for renewable energy transition for South Africa. The aim of this policy was to produce 10,000 GWh of renewable energy by 2013 by investing in solar, biomass and hydropower. In addition, the City of Johannesburg has the Energy and Climate Change Strategy and Action Plan: Climate Change Strategic Framework for City of Johannesburg and is in the process of formulating an Energy Plan which aims to transform the City to 50% renewable energy by the year 2050

### 5.3.3 What is the green agenda, and how have different sectors in the City of Johannesburg integrated it to programmes or projects?

The common response of what the green agenda is from the participants was that which is concerned with preserving the urban environment through implementing measures that promote sustainable urban areas. To this regard, several sectors such as Department of Energy and the City of Johannesburg have implemented measures such as the Solar Water Heaters Programs whose intention is to use renewable energy to heat water. The Corridors of Freedom is another program that the City of Johannesburg implemented to promote the green agenda through densification, compaction and mix land use, and mass public transportation. The

intention is to have proximity of economic activities to allow reduced use of personal vehicle and in turn reducing GHGs.

Further, another program is the Joburg Waste to Energy where methane produced from the waste by bacteria is turned into energy, currently this project produced 1.1MW of electricity which is supplied to the Northern Water Treatment Plant.

The conclusion drawn from these findings is that the City is addressing the issues of integrating the green agenda to promote urban sustainability in Johannesburg as witnessed from the strategies such as Corridors of freedom, the energy efficient buildings, partnership among others. However, the fragmented and unequal urban form coupled with the budget constraints influenced by political interventions has made it difficult for the City to achieve its objectives. This is the reason why Johannesburg still has high GHGs emissions.

## 5.4 Research Reflections and Impacts to Urban Development Planning

This study investigated the integration of the green agenda in energy policy to promote urban sustainability. The use of the City of Johannesburg as a case study has presented a comprehensive perspective on how cities play a role in promoting sustainability. Linking the green agenda to urban sustainability through energy policy has shown the urgent need for cities to incorporate spatial planning and energy efficiency in their urban development agenda. Planners play a significant role in shaping urban spaces. For the case of South Africa, which still has a legacy of apartheid, urban planning can be used as a tool to reconcile these issues by creating an inclusive city. The step taken by the City of Johannesburg to create a compact polycentric city is commendable as this is trying to 'clear the scars' of apartheid by creating a city that is inclusive and equal. This model is beneficial to the city as it fosters economic, social, and environmental dimensions of the growth of the city. In addition, this is important for urban management because compact cities have been alluded to be smart urbanism techniques

## 5.5 Recommendations

There is a need for policies formulated to be implemented without political influence or impact with a realisation that the policies are being implemented for a better South Africa. In this regard, when there is a shift of government, policies implemented should not be stalled but continued to achieve the set objectives. Unlike what happened to the Corridors of Freedom whose implementation stalled due to budget constraints after the Council changed leadership.

Similarly, policy implementers must ensure that all stakeholders understand the implications of the policy being implemented to avoid ambiguity in understanding the policy. This would contribute to consistency in the implementation of policies.

## 5.6 Areas for Further Research

This research has offered an insight in the integration of the green agenda in energy policy to promote urban sustainability. However, based on this study's findings, there are still gaps that could be explored as future areas of research. Below are the three areas for future research-:

- Does a compact polycentric model alleviate the impact of GHGs emitted from urban traffic? A Case of Impacts of the Corridors of Freedom
- Has the implementation of Corridors of Freedom fostered spatial inclusion in Johannesburg?

## 5.7 Conclusion

This research set out to investigate if the green agenda is being integrated in energy policy to promote urban sustainability. Based on the literature reviewed and the interviews conducted with key departments related to this research, key findings have been discussed above and indeed the City is integrating the green agenda yet it has faced challenges which include fragmented urban form, political interventions, and budget constraints. The findings provide answers to the main research question which was concerned with how the green agenda is being integrated in energy policy formulation. The study views spatial planning concepts such as compact cities, densification, mixed land use and green infrastructure in addition to transition to renewable energy sources is key to attaining sustainability in energy policy. This is mainly due to the multifunctionality of spatial planning and its ability to reconcile the three different dimensions of sustainability to harness efficient use of resources.

The study revealed how the City of Johannesburg has implemented different plans and strategies such as the Corridors of Freedom, the energy efficient buildings, renewable energy to enable the integration of the green agenda to promote urban sustainability. Yet, the inadequate enforcement coupled mainly with financial constraints and political volatility and the legacies of apartheid spatial planning have hindered Johannesburg from fully attaining urban sustainability. Consequently, the city remains amongst the highest GHGs emitters in South Africa and Africa

# 6 References


Abrahams, C. and Everatt, D., 2019. City Profile: Johannesburg, South Africa. *Environment and Urbanization ASIA*, *10*(2), pp.255-270.

Akinbami, O.M., Oke, S.R. and Bodunrin, M.O., 2021. The state of renewable energy development in South Africa: An overview. *Alexandria Engineering Journal*, *60*(6), pp.5077-5093

Allen, C., Metternicht, G. and Wiedmann, T., 2019. Prioritising SDG targets: Assessing baselines, gaps and interlinkages. *Sustainability Science*, *14*(2), pp.421-438

Arioli, M.S., Márcio de Almeida, D.A., Amaral, F.G. and Cybis, H.B.B., 2020. The evolution of city-scale GHG emissions inventory methods: A systematic review. *Environmental Impact Assessment Review*, *80*, p.

Arundel, R. and Ronald, R., 2017. The role of urban form in sustainability of community: The case of Amsterdam. *Environment and Planning B: Urban Analytics and City Science*, *44*(1), pp.33-53.

Basso, L.J., Feres, F. and Silva, H.E., 2019. The efficiency of bus rapid transit (BRT)systems: A dynamic congestion approach. *Transportation Research Part B: Methodological*, *127*, pp.47-71.

Bibri, S.E., 2020. *Advances in the leading paradigms of urbanism and their amalgamation: compact cities, eco–cities, and data–driven smart cities*. Springer Nature.2020.

Bibri, S.E., Krogstie, J. and Kärrholm, M., 2020. Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability. *Developments in the built environment*, *4*, pp1-21.

Braun, V. and Clarke, V., 2006. Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), pp.77-101.

British Petroleum, 2020. Statistical Review of World Energy, London.

Brundtland, G.H., 1987. Our common future Oxford University Press. *New York*.

Busayo, E.T., Kalumba, A.M. and Orimoloye, I.R., 2019. Spatial planning and climate change adaptation assessment: Perspectives from Mdantsane Township dwellers in South Africa. *Habitat International*, *90*, pp 1-9.

Bush, J., 2020. The role of local government greening policies in the transition towardsnature-based cities. *Environmental Innovation and Societal Transitions*,*35*, pp.35-44.

Buyanda, N., (Personal Communication, 22 September,2020), Director, Environmental and Infrastructure Services, Johannesburg, Microsoft teams.

Campagnolo, L., Carraro, C., Eboli, F., Farnia, L., Parrado, R. and Pierfederici, R., 2018. The ex-ante evaluation of achieving sustainable development goals. *Social Indicators Research*, *136*(1), pp.73-116.

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D. and Walker, K., 2020. Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, *25*(8), pp.652-661.

Cavoli, C., 2021. Accelerating sustainable mobility and land-use transitions in rapidly growing cities: Identifying common patterns and enabling factors. *Journal of Transport Geography*, *94*, pp.1-13.

Chigudu, A. and Chirisa, I., 2020. The quest for a sustainable spatial planning framework in Zimbabwe and Zambia. *Land Use Policy*, *92*, pp.1-7.

Cilliers, J. and Victor, H., 2018. Considering spatial planning for the South African poor: An argument for 'planning with'. *Town and Regional Planning*, *72*, pp.29-42.

Cilliers, E.J., 2019. Reflecting on green infrastructure and spatial planning in Africa: The complexities, perceptions, and way forward. *Sustainability*, *11*(2), p.455.

City of Johannesburg, 2009. *Climate Change Adaption Plan*. City of Johannesburg, Johannesburg.

City of Johannesburg, 2018. *2017/2018 Integrated Development Plan Review*, Johannesburg.

City of Johannesburg, 2018. *The State of the City: Exploring Johannesburg as a Series of Villages*, City of Johannesburg, Johannesburg.

City of Johannesburg, 2019. *Integrated Development Plan 2019/20 Review*, City of Johannesburg, Johannesburg.

City of Johannesburg (CoJ), 2013. *Economic overview: 2013 A review of the state of the economy and other key indicators*, City of Johannesburg, Johannesburg.

City of Johannesburg, 2020. *Integrated Development Plan 2020/21*, Johannesburg, City of Johannesburg, Johannesburg.

Cordova, A. and Stanley, K.D., 2021. Public-private partnership for building a resilient broadband infrastructure in Puerto Rico. *Telecommunications Policy*, *45*(4), pp.1-10.

Charmes, E. & Keil, R. (2015). The Politics of Post-Suburban Densification in Canada and France. *International Journal of Urban and Regional Research*, 39(3), pp. 581-602.

Creswell, J. W., 2012. *Educational research: Planning, conducting, and evaluation quantitative and qualitative research* (4th ed.). Boston, MA: Pearson Education.

Curtis, C., Renne, J. L. & Bertolini, L. (2016). *Transit Oriented Development: Making it Happen.* London: Routledge.

Department of Minerals and Energy, 1998. *White Paper on Energy*, Department of Minerals and Energy, Pretoria

Department of Minerals and Energy, 2003. *White Paper on Renewable Energy*, Department of Minerals and Energy, Pretoria

Dlamini, A (Personal Communication, 01 October,2020), Policy Analysist, Development Planning Department, Johannesburg, Microsoft teams.

Escobedo, F.J., Giannico, V., Jim, C.Y., Sanesi, G. and Lafortezza, R., 2019. Urban forests, ecosystem services, green infrastructure and nature-based solutions: Nexus or evolving metaphors. *Urban Forestry & Urban Greening*, *37*, pp.3-12.

Eskom,2017. *Solar Water Heating Rebate Programme*: COP17 Fact Sheet

Gao, S. and Zhang, H., 2020. Urban Planning for Low-Carbon Sustainable Development. *Sustainable Computing: Informatics and Systems*, pp.1-7.

Gauteng City-Region Observatory (GCRO), 2021. Unemployment and Population Distribution Map, Johannesburg.

Gauteng Province Department of Local Government and Housing., 2010. Gau*teng Integrated Energy Strategy,* Pretoria.

Google Earth, 2021. Image of Alexandra.

Google Earth,2021. Image of Greenside.

Government of South Africa, 1996.*Constitution of the Republic of South Africa*, Pretoria.

Harrison, P., Rubin, M., Appelbaum, A. and Dittgen, R., 2019. Corridors of freedom: Analyzing Johannesburg's ambitious inclusionary transit-oriented development. *Journal of Planning Education and Research*, *39*(4), pp.456-468.

Högström, J., Brokking, P., Balfors, B. and Hammer, M., 2021. Approaching Sustainability in Local Spatial Planning Processes: A Case Study in the Stockholm Region, Sweden. *Sustainability*, *13*(5), pp. 294–304.

Horn, A., 2019. The history of urban growth management in South Africa: tracking the origin and current status of urban edge policies in three metropolitan municipalities. *Planning Perspectives*, *34*(6), pp.959-977

Huang, P., Broto, V.C. and Liu, Y., 2018. From "transitions in cities" to "transitions of cities": The diffusion and adoption of solar hot water systems in urban China. *Energy Research & Social Science*, *36*, pp.156-164.

Iizuka, S., Xuan, Y., Takatori, C., Nakaura, H. and Hashizume, A., 2020. Environmental impact assessment of introducing compact city models by downscaling simulations. *Sustainable Cities and Society*, *63*, pp.1-9.

IPCC. (2019). Summary for policymakers. In P. R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. P¨ortner, D. C. Roberts, … J. Malley (Eds.), *Climate change and land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. IPCC. In press. Available at: https://www.ipcc.ch/srccl/ (Accessed 28 Dec. 2020).

Javadi, R., 2021. Urban green space and health: The role of thermal comfort on the health benefits from the urban green space; a review study. *Building and Environment*, pp.1-14.

Johnsson, F., Kjärstad, J. and Rootzén, J., 2019. The threat to climate change mitigation posed by the abundance of fossil fuels. *Climate Policy*, *19*(2), pp.258-274.

Kakar, K.A. and Prasad, C.S.R.K., 2020. Impact of urban sprawl on travel demand for public transport, private transport and walking. *Transportation research procedia*, *48*, pp.1881-1892.

Keitsch, M., 2018. Structuring ethical interpretations of the sustainable development goals—Concepts, implications and progress. *Sustainability*, *10*(3), p.829.

Khan, S. & Carville, A. (2017). To follow the Australian dream or to embrace urban densification: a prolonged debate? In J. H. P. Bay & S. Lehmann (Red.). *Growing Compact: Urban Form, Density and Sustainability* (pp. 300-316). Abingdon: Routledge.

Kim, J.H. and Li, X., 2021. Building more housing near transit: A spatial analysis of residential densification dynamics. *Transport Policy*.

Korthals Altes, W.K., 2019. Multiple land use planning for living places and investments spaces. *European Planning Studies*, *27*(6), pp.1146-1158.

Li, W., Feng, T., Timmermans, H.J., Li, Z., Zhang, M. and Li, B., 2020. Analysis of citizens' motivation and participation intention in urban planning. *Cities*, *106*, pp.1-9.

Liu, H. and Ma, L., 2020. Spatial Pattern and Effects of Urban Coordinated Development in China's Urbanization. *Sustainability*, *12*(6), pp.1-16.

Liu, O.Y. and Russo, A., 2021. Assessing the contribution of urban green spaces in green infrastructure strategy planning for urban ecosystem conditions and services. *Sustainable Cities and Society*, *68*, pp.1-19.

Lv, T., Wang, L., Xie, H., Zhang, X. and Zhang, Y., 2021. Exploring the Global Research Trends of Land Use Planning Based on a Bibliometric Analysis: Current Status and Future Prospects. *Land*, *10*(3), pp.1-19.

Mabin, A., 2013. The Map of Gauteng: Evolution of a City-region in Concept and Plan. GCRO Occasional Paper 5. Johannesburg: GCRO.

Mabin, A., 2013. The map of Gauteng: Evolution of a city-region in concept and plan.

Makakavhule, K. and Landman, K., 2020. Towards deliberative democracy through the democratic governance and design of public spaces in the South African capital city, Tshwane. *URBAN DESIGN International*, *25*, pp.280-292.

Mainak, B., 2015. Making Your Green Agenda Business Friendly.29 December. INTERNET: www.indusnet.co.in/making-green-agenda-business-friendly/. Last accessed 13 Febuary,2021.

Meerow, S., 2020. The politics of multifunctional green infrastructure planning in New York City. *Cities*, *100*, pp.1-12.

Mell, I. and Clement, S., 2020. Progressing green infrastructure planning: Understanding its scalar, temporal, geo-spatial and disciplinary evolution. *Impact Assessment and Project Appraisal*, *38*(6), pp.449-463

Mensah, C.A., 2014. Destruction of urban green spaces: A problem beyond urbanization in Kumasi city (Ghana). *American Journal of Environmental Protection*, *3*(1), pp.1-9.

Modingoane, N**.,** 2012. Launch of Solar Water Heating Programme by City Power, Johannesburg,8Octobe.INTERNET:https://www.joburg.org.za/media_/MediaStatements/Pages/2012%20Press%20Releases/08102012-Launch-of-Solar-Water-Heating-Programme-by-City-Power-.aspx

Mosera, A. and Korstjensc, I., 2017. Series: Practical guidance to qualitative research. Part 1: Introduction. European *Journal of General Practice*, Vol. 23, No. 1, 271–273.

Müller-Eie, D., 2018, May. Geographic transport planning principles in Norwegian city regions: The case of work travel in Stavanger. In *The 4th Conference on Sustainable Urban Mobility* (pp. 780-788).

Nabil, N.A. and Abd Eldayem, G.E., 2015. Influence of mixed land-use on realizing the social capital. *HBRC Journal*, *11*(2), pp.285-298.

Ndlangamandla, M., 2017. Pikitup Sets Solid Waste-To-Energy Standard, 29 September INTERNET: http://www.pikitup.co.za/wp-content/uploads/2017/09/National-Clean-up-and-Recycle-Week-South-Africa-...pdf accessed:11/12/20

Nengroo, Z.A., Bhat, M.S. and Kuchay, N.A., 2017. Measuring urban sprawl of Srinagar city, Jammu and Kashmir, India. *Journal of Urban Management*, *6*(2), pp.45-55.

Nero, B.F., Callo-Concha, D. and Denich, M., 2019. Increasing Urbanisation and the Role of Green Spaces in Urban Climate Resilience in Africa. In *Environmental Change and African Societies*, pp. 265-296.

Pan, S., Roy, A., Choi, Y., Sun, S. and Gao, H.O., 2019. The air quality and health impacts of projected long-haul truck and rail freight transportation in the United States in 2050. *Environment international*, *130*, pp.1-10.

Pasquini, L. and Enqvist, J.P., 2019. Green Infrastructure in South African Cities Report for cities support programme. Cape Town: National Treasure of the Republic of South Africa, African Centre for Cities

Sarantakos, S., 2005. *Social Research*. Third Edition. Palgrave Macmillan, London. pp 106-127

Raman, R. and Roy, U.K., 2019. Taxonomy of urban mixed land use planning. *Land Use Policy*, *88*, pp.1-9.

Schäffler, A. and Swilling, M., 2013. Valuing green infrastructure in an urban environment under pressure—The Johannesburg case.*Ecological Economics*,*86*, pp.246-257.

Schmitt, P. and Wiechmann, T., 2018. Unpacking spatial planning as the governance of place: Extracting potentials for future advancements in planning research. *The Planning Review*, *54*(4), pp.21-33.

Sénit, C.A., 2020. Transforming our world? Discursive representation in the negotiations on the Sustainable Development Goals. *International Environmental Agreements: Politics, Law and Economics*, *20*(3), pp.411-429.

Shackleton, C.M. and Gwedla, N., 2021. The Legacy Effects of Colonial and Apartheid Imprints on Urban Greening in South Africa: Spaces, Species, and Suitability. *Frontiers in Ecology and Evolution*, *8*, pp.1-12.

Shackleton, C.M., Blair, A., De Lacy, P., Kaoma, H., Mugwagwa, N., Dalu, M.T. and Walton, W., 2018. How important is green infrastructure in small and medium-sized towns? Lessons from South Africa. *Landscape and Urban Planning*, *180*, pp.273-281.

Shi, L., Han, L., Yang, F. and Gao, L. 2019. The Evolution of Sustainable Development Theory: Types, Goals, and Research Prospects. Sustainability, Vol 11 (24), pp.1-16.

Staddon, C., Ward, S., De Vito, L., Zuniga-Teran, A., Gerlak, A.K., Schoeman, Y., Hart, A. and Booth, G., 2018. Contributions of green infrastructure to enhancing urban resilience. *Environment Systems and Decisions*, *38*(3), pp.330-338.

Statistics South Africa (Stats SA), 2011. Census 2011 South Africa. Pretoria.

Sustania, 2018. Johannesburg: Waste to Energy Partnership Saves Money,18 aJune,2018. INTERNET:https://goexplorer.org/johannesburg-waste-to-energy-partnership-saves-money/accessed 08/09/21.

Tappert, S., Klöti, T. and Drilling, M., 2018. Contested urban green spaces in the compact city: The (re-) negotiation of urban gardening in Swiss cities. *Landscape and urban planning*, *170*, pp.69-78.

The International Renewable Energy Agency (IRENA)., 2016. *Renewable Energy in Cities*, International Renewable Energy Agency (IRENA), Abu Dhabi, www.irena.org.

The International Renewable Energy Agency (IRENA), 2018. *Mitigating Climate Change Through Renewable Energy Development*, Cape Town.

Turok, I., 2016. Getting urbanisation to work in Africa: The Role of the Urban Land-Infrastructure-finance nexus. *Area Development and Policy*, 1:1, 30-47.

United Nations Department of Economic and Social Affairs (UNDESA), 2015. *World Population Prospects: The 2015 Revision.* United Nations Department of Economic and Social Affairs, New York.

United Nations, 2015. *United Nations Framework Convention on Climate Change – Paris Agreement.* United Nations, Paris.

United Nations, 2017. *The New Urban Agenda – Habitat III.* United Nations, Quito.

Ureta, Joan, Marzieh Motallebi, Amy E. Scaroni, Susan Lovelace, and J. Carl Ureta, (2021). Understanding the public's behavior in adopting green stormwater infrastructure. *Sustainable Cities and Society*, 69, pp.1-15.

Venter, Z.S., Shackleton, C.M., Van Staden, F., Selomane, O. and Masterson, V.A., 2020. Green Apartheid: Urban green infrastructure remains unequally distributed across income and race geographies in South Africa. *Landscape and Urban Planning*, *203*, pp.1-12.

Wang, N., Verzijlbergh, R.A., Heijnen, P.W. and Herder, P.M., 2020. A spatially explicit planning approach for power systems with a high share of renewable energy sources. *Applied Energy*, *260*, pp.1-15.

Wang, S.H., Huang, S.L. and Huang, P.J., 2018. Can spatial planning really mitigate carbon dioxide emissions in urban areas? A case study in Taipei, Taiwan. *Landscape and Urban Planning*, *169*, pp.22-36.

Xavier, L.Y., Jacobi, P.R. and Turra, A., 2019. Local Agenda 21: Planning for the future, changing today. *Environmental Science & Policy*, *101*, pp.7-15.

Yin, R., 1994. *Case Study Research: Design and Methods, 2nd Edition* (or earlier editions). Sage, Thousand Oaks.

Yin, R., 2003. Case study research: Design and methods. 3rd edition. Sage, Thousand Oaks.

Yunda, J.G. and Sletto, B., 2020. Densification, private sector-led development, and social polarization in the global south: Lessons from a century of zoning in Bogotá. *Cities*, *97*, pp. 1-12.

Zuniga-Teran, A.A., Staddon, C., de Vito, L., Gerlak, A.K., Ward, S., Schoeman, Y., Hart, A. and Booth, G., 2020. Challenges of mainstreaming green infrastructure in built environment professions. *Journal of Environmental Planning and Management*, *63*(4), pp.710-732.

Zhang, H., Peng J., Wang R., Zhang J., and Yu D., 2021. Spatial planning factors that influence CO2 emissions: A systematic literature review. *Urban Climate* 36 (2021) pp.1-14.

# 7 Appendices

## Appendix One: Ethics Clearance Certificate

SCHOOL OF ARCHITECTURE AND PLANNING
HUMAN RESEARCH ETHICS COMMITTEE

SCHOOL OF ARCHITECTURE AND PLANNING

**CLEARANCE CERTIFICATE**
**PROTOCOL NUMBER:** SOAP080/06/2020

| | |
|---|---|
| **PROJECT TITLE:** | Investigating How Cities Are Promoting Urban Sustainability by Integrating Renewable Energy: Case of Johannesburg |
| **INVESTIGATOR/S:** | Phiri Violet (Student No: 2374488) |
| **SCHOOL:** | Architecture and Planning |
| **DEGREE PROGRAMME:** | Master of Urban Studies (**MUS UM**) |
| **DATE CONSIDERED:** | 05 August 2020 |
| **EXPIRY DATE:** | 05 August 2021 |
| **DECISION OF THE COMMITTEE:** | Approved |

**CHAIRPERSON** _____
(Dr Brian Boshoff)

**DATE:** Signed under lockdown: 10.8.20

cc: Supervisor/s: Tsepang Leuta

**DECLARATION OF INVESTIGATORS**
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to endure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

**Signature** **Date**

School of Architecture & Planning
University of the Witwatersrand
Private Bag 3 Wits 2050
Johannesburg South Africa
www.wits.ac.za

T +27 11 717 7623
F +27 11 717 7649

SCHOOL OF ARCHITECTURE PLANNING

## Appendix Two. Participant information sheet

**PARTICIPANT INFORMATION SHEET**

16th June 2020.

Dear Sir / Madam,

My name is Violet Phiri and I am a master's student in Urban Management at the University of the Witwatersrand. As part of my studies, I have to undertake a research project, the title of my research is **An Investigation of How the Green Agenda is Being Integrated in the Energy Sector To Promote Urban Sustainability in Johannesburg** and the aim of this research is to explore if formulation of the current policies to promote urban sustainability and the green agenda in the City of Johannesburg is tallying with implementation.

As part of this project, I would like to seek permission from your office to interview officers from Environment and Infrastructure Services Department and Development Planning to take part in answering a questionnaire. The aim of the questionnaire is to supplement the data that will not be available in the secondary data that am reviewing. I aim to get more insight on what the City is doing regarding the green agenda and urban sustainability from the officers. This questionnaire will take around twenty minutes to complete. The interview will be completely confidential and anonymous as I will not require their identity, and the information given to me will be kept securely and not disclosed to anyone else.

The information will purely be used for academic purposes and the research report will be available online through the university library website.

Yours sincerely,

Violet Phiri,
Email: 2374488@students.wits.ac.za
Phone Number:0633481638

Supervisor: Dr Tsepang Leuta
Email: tsepang.leuta1@wits.ac.za
Phone number: (011) 717 7718

1

# Appendix Three: Interview structures

## City of Johannesburg Questionnaire

THE UNIVERSITY OF THE WITWATERSRAND,

SCHOOL OF ARCHITECTURE AND PLANNING

RESEARCH QUESTIONNAIRE

**TOPIC: AN INVESTIGATION OF HOW THE GREEN AGENDA IS BEING INTEGRATED IN THE ENERGY SECTOR TO PROMOTE URBAN SUSTAINABILITY IN JOHANNESBURG**

**BY VIOLET PHIRI**

My name is Violet Phiri and I am a Master's student in Urban Management at the University of the Witwatersrand. As part of my studies, I have to undertake a research project, the title of my research is **An Investigation of How the Green Agenda is Being Integrated in the Energy Sector To Promote Urban Sustainability in Johannesburg**
The aim of this research is to explore if there are strategies formulated and if the formulation of the current policies to promote urban sustainability and the green agenda in the City of Johannesburg is tallying with implementation.

As part of this project, I would like to invite you to take part in answering a questionnaire which will take an hour to complete. I will not require your identity, and the information you give to me will be held securely and not disclosed to anyone else. I will be using a pseudonym (false name) to represent your participation in my final research report.
For further details, you can email me on **2374488@students.wits.ac.za**

1

**DATE OF INTERVIEW:**.....

**NAME OF DEPARTMENT:**.....

**SECTION A: DEMOGRAPHICS**

| | |
|---|---|
| Position | |
| Responsibility | |
| Years in The Department | |

**SECTION B: LEGISLATION AND POLICY**

1. Are there any strategies available addressing the green agenda and urban sustainability?.....
2. When were the strategies formulated?.....
3. Are there any mid-term plans for the green agenda in promoting urban sustainability in the City?.....
4. What are the City's long term plans for the green agenda in promoting urban sustainability?.....
5. Are there strategies that are addressing the promotion of urban sustainability amidst the high levels of green house gases?.....

**SECTION C: GREEN AGENDA**

1. How does this department define the green agenda?

.....

.....

.....

……
……

2. Would you say that the green agenda is sufficiently being promoted in planning in the City?.....
……
……
……

3. What does the concept of green agenda mean to you as an officer dealing in planning/environmental management?
……
……
……
……

4. What does the concept of green agenda mean to the department?.....
……
……
……

5. What role do you think the green agenda plays in the Energy sector to reduce air pollution in the City?.....
……
……
……

6. How does the department understand that role?.....
……
……

7. What are the opportunities and constraints for strengthening the green agenda in the energy sector to promote urban sustainability? ……
……
……

8. What challenges does the City face in integrating the green agenda in the planning?
……
……
……
……

**SECTION D: URBAN SUSTAINBILITY**

1. What is the department's main role in planning for sustainable urban areas?
……
……
……
……
……

2. What do you think can be done to promote urban sustainability in Johannesburg?.....
……

.....
.....

3. What's your take on the pollution that comes from the generation of electricity in the City?.....
.....
.....
.....
.....

4. What challenges does the City face as consequences of the high air pollution?.....
.....
.....
.....

5. What adverse effects do greenhouse gases generated from electricity production have on urban sustainability?.....
.....
.....
.....

**Thank you for your time.**

# National Energy Regulator of South Africa's Questionnaire

THE UNIVERSITY OF THE WITWATERSRAND,

SCHOOL OF ARCHITECTURE AND PLANNING


RESEARCH QUESTIONNAIRE

**TOPIC: AN INVESTIGATION OF HOW THE GREEN AGENDA IS BEING INTEGRATED IN THE ENERGY SECTOR TO PROMOTE URBAN SUSTAINABILITY IN JOHANNESBURG**

**BY VIOLET PHIRI**

My name is Violet Phiri and I am a Master's student in Urban Management at the University of the Witwatersrand. As part of my studies, I have to undertake a research project, the title of my research is **An Investigation of How the Green Agenda is Being Integrated in the Energy Sector To Promote Urban Sustainability in Johannesburg**
The aim of this research is to explore if there are strategies formulated and if the formulation of the current policies to promote urban sustainability and the green agenda in the City of Johannesburg is tallying with implementation.

As part of this project, I would like to invite you to take part in answering a questionnaire which will take an hour to complete. I will not require your identity, and the information you give to me will be held securely and not disclosed to anyone else. I will be using a pseudonym (false name) to represent your participation in my final research report.
For further details, you can email me on **2374488@students.wits.ac.za**

1

**DATE OF INTERVIEW**.....
.....

**NAME OF DEPARTMENT**.....
.....

**SECTION A: DEMOGRAPHICS**

| | |
|---|---|
| **Position** | |
| **Responsibility** | |

**SECTION B: LEGISLATION AND POLICY**

1. Are there any energy strategies and policies available addressing the green agenda and urban sustainability?.....
.....
.....
.....
.....
2. How electricity production and GHG emissions is translated in the green agenda?.....
.....
.....
.....
3. If yes, what are they?.....
.....
.....
.....
4. When were they formulated?.....
.....
.....
5. Are they being implemented?.....
.....
.....
6. What adverse effects do greenhouse gases generated from electricity production have on urban sustainability?.....
.....
.....
.....
.....

7. Are there any mid-term plans for the green agenda in promoting urban sustainability ?.....
.....
.....
.....
.....
.

8. What are the Authority long term plans for the green agenda in energy policy formulation in promoting urban sustainability?.....
.....
.....
.....
.....

9. Are there strategies that are addressing the promotion of urban sustainability amidst the high levels of green house gases?.....
.....
.....
.....
.....

**SECTION C: GREEN AGENDA**

1. What does the concept of green agenda mean to the Authority since you are energy regulators in the nation?
.....
.....
.....
.....
..... .....

2. What doe the concept of sustainability mean to the Authority?.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

3. What are the opportunities and constraints for strengthening the green agenda in the energy sector to promote urban sustainability? .....
.....
.....
.....

4. What challenges does the Authority face in integrating the green agenda in the formulation of energy policies?

   .....
   .....
   .....
   .....
   .....

5. What institutional challenges does the Authority face in integrating the green agenda in the formulation of energy
   policies?.....
   .....
   .....
   .....

6. Do you think the strategies the City of Johannesburg has in place are aligning with the policies
   formed?.....
   .....
   .....

7. Would you say the City of Johannesburg is doing adequately promoting the green agenda to promote urban sustainability in relation to energy?

.....
.....
.....
.....
.....
.....

8. Do you think they can do better? Yes/No

   .....

9. If yes how, what would you suggest they City can do to improve?.....
   .....
   .....
   .....

**Thank you for your time.**

## Appendix Four: Topic Approval Letter

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 02711 7177009
Tel: 02711 7177007

Reference: Ms Olga Ndlovu
E-mail: olga.ndlovu@wits.ac.za

04 August 2020
Person No: 2374488
PAG

Miss V Phiri
P.O Box 35327
10101
Zambia

Dear Miss Violet Phiri

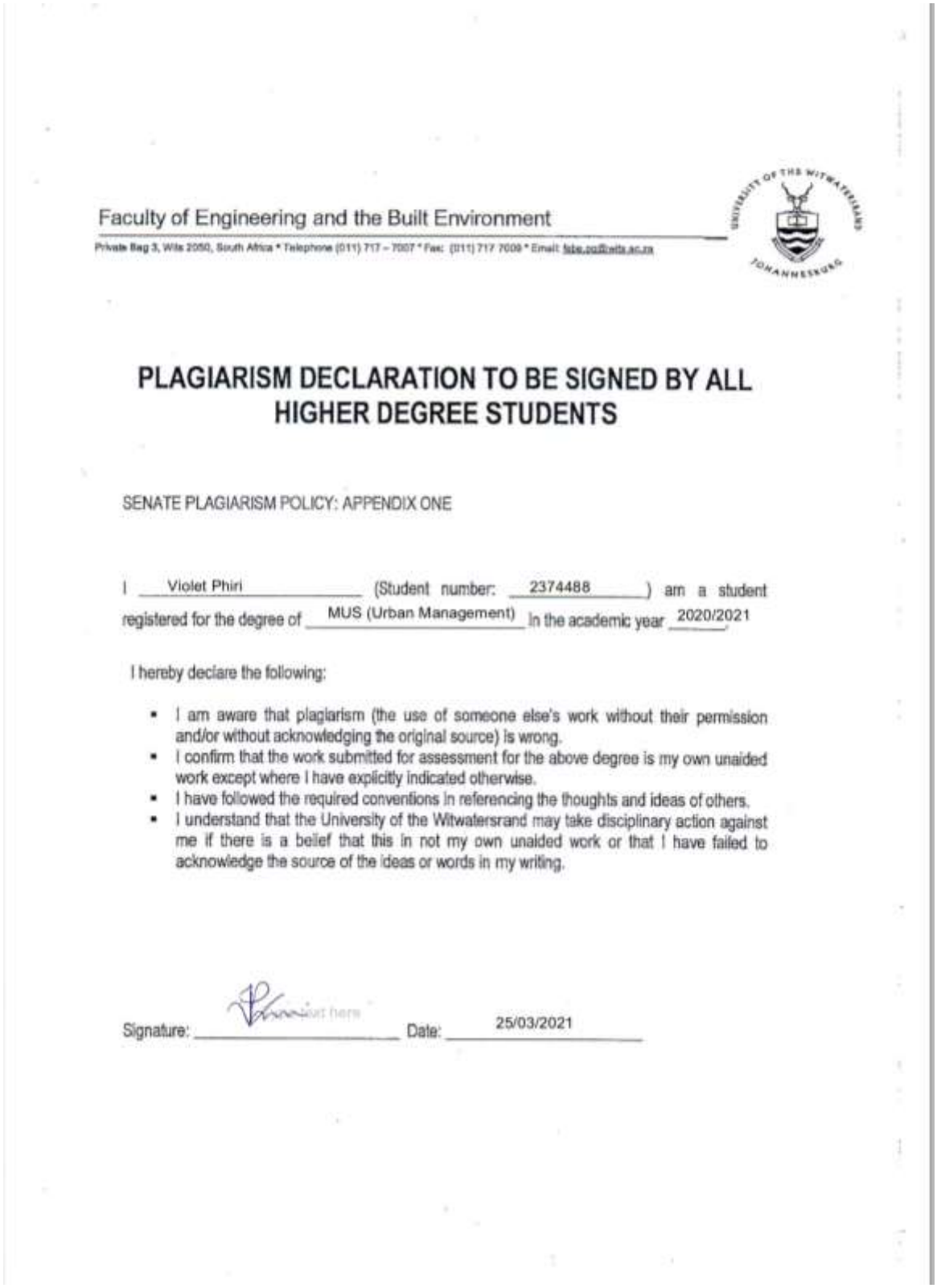
**Master of Urban Studies: Approval of Title**

We have pleasure in advising that your proposal entitled *An Investigation of How the Green Agenda Is Being Integrated In The Energy Sector To Promote Urban Sustainability In Johannesburg.* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mr Yaseen Stoffberg
Faculty Registrar
Faculty of Engineering and the Built Environment

## Appendix Five: Plagiarism Declaration Form



Faculty of Engineering and the Built Environment

Private Bag 3, Wits 2050, South Africa * Telephone (011) 717 – 7007 * Fax: (011) 717 7009 * Email: febe.pa@wits.ac.za

# PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I Violet Phiri (Student number: 2374488) am a student registered for the degree of MUS (Urban Management) in the academic year 2020/2021.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this in not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

Signature: [signature] Date: 25/03/2021