University of Cape Town

Faculty of Engineering and the Built Environment

INCENTIVES AND DRIVERS FOR PROPERTY OWNERS TO PURSUE PRIVATE EMBEDDED GENERATION THROUGH SOLAR PHOTOVOLTAIC SYSTEMS

Prepared By:

Michelle Scholtz (SCHMIC083)

Supervisor:

Dr Louie van Schalkwyk

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Abstract

South Africa has been experiencing an energy crisis for over sixteen years, leading to an increase in the frequency and duration of power cuts. The energy crisis has a detrimental impact on the country's economy, and consequently, on residential and non-residential private property owners. Furthermore, the country is heavily reliant on coal for energy generation, which requires the move towards a more sustainable energy mix. Renewable energy generation, especially in the form of rooftop solar photovoltaic (PV) systems, is expected to play an important role in South Africa's future energy systems.

The national government, along with various municipalities at local government level, are introducing regulatory incentives to promote the uptake of solar PV systems in the private sector. These incentives include feed-in tariffs, capital subsidies and tax benefits. In addition to the regulatory incentives, there are non-regulatory drivers that motivate private property owners to pursue solar PV systems. These drivers include environmental considerations, cost savings, energy security, tenant requirements, and green-energy finance.

This study examines the various regulatory incentives available to private property owners located in the City of Cape Town (CoCT) to pursue solar PV systems. The CoCT was selected as a single case study as the municipality creates a conducive environment through their regulatory framework for private property owners to pursue private embedded generation systems. The report examines the different incentives applicable to residential and non-residential property owners. The research also establishes to what extent the regulatory incentives influence private property owners to pursue solar PV systems, when compared to non-regulatory drivers and benefits. A literature review was conducted and the respondents were interviewed to determine the extent of national and municipal regulatory incentives available to residential and non-residential private property owners and whether these incentives are considered a determining factor in pursuing solar PV systems, when compared to non-regulatory drivers.

The study revealed that the various regulatory incentives differ somewhat for residential and non-residential property owners. These differences impact the extent to which the regulatory incentives motivate particular private property owners to

pursue solar PV systems. The research suggests that, although the regulatory incentives play a significant role in private property owners' decision-making process, the non-regulatory drivers are considered to be the main motivating factor for private property owners pursuing solar PV systems.

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List of Abbreviations

AC	Alternating Current
CoC	Certificate of Compliance
CoCT	City of Cape Town Metropolitan Municipality
COP	Conference of the Parties
c/kWh	Cents per Kilowatt-Hour
DC	Direct Current
DMRE	Department of Mineral Resources and Energy
DPE	Department of Public Enterprises
EAF	Energy Availability Factor
EGI	Embedded Generation Installation
EPC	Energy Performance Certificates
ERA	Electricity Regulation Act No. 4 of 2006
ESG	Environmental and Social Governance
EVN	Vietnam Electricity
FiT	Feed-in Tariff
GDP	Gross Domestic Product
IEP	Integrated Energy Plan
IRP	Integrated Resource Plan
JET IP	Just Energy Transition Investment Plan
MED	Municipal Electricity Distributors
MW	Megawatt
NDC	Nationally Determined Contribution
NERA	National Energy Regulator Act No. 40 of 2004

NERSA	National Energy Regulator of South Africa
PPA	Power Purchase Agreement
PV	Photovoltaic
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
REIT	Real Estate Investment Trust
R/kVa	Rands per Kilovolt-Ampere
SA	South Africa
SAESA	South African Energy Storage Association
SANEDI	South African National Energy Development Institute
SAPVIA	South African Photovoltaic Industry Association
SARB	South African Reserve Bank
SAREM	South African Renewable Energy Masterplan
SARS	South African Revenue Service
SAWEA	South African Wind Energy Association
SME	Small and Medium Enterprises
TOU	Time of Use
ULCF	Unplanned Capability Loss Factor
UNFCCC	United Nations Framework Convention on Climate Change

CHAPTER 1: INTRODUCTION

1.1 Introduction

This study investigates the regulatory incentives and non-regulatory drivers for residential and non-residential private property owners to pursue private embedded generation through solar photovoltaic (PV) systems. This chapter contextualises the research topic by providing a brief overview of the current energy crisis in South Africa and the resultant impact on the economy and environment. The chapter also explains the regulatory framework and incentives relating to private embedded generation through solar PV systems. In addition to the regulatory incentives, this chapter highlights the relevance of the non-regulatory drivers associated with the implementation of solar PV systems.

Furthermore, this chapter outlines the problem statement, research questions and aim of this research report. The chapter also identifies and describes the research objectives in terms of the research questions, outlines the research methodology and defines the scope and limitations of this study. The structure of this dissertation is set out at the end of this chapter.

1.2 Background to the Study

South Africa has been experiencing power cuts since 2007 due to major issues in the supply and distribution of electricity (Sadek, 2022). Over the past sixteen years, these power cuts have been labelled as *"loadshedding"* and have become more frequent and lasting for longer periods of time. Loadshedding generally occurs due to aging infrastructure, lack of maintenance and limited funds to invest in new capacity (De Ruyter, 2023). This can mainly be ascribed to mismanagement and systematic corruption in the state-owned utility company, Eskom, who is responsible for the generation, transmission and distribution of electricity in South Africa (Gretener and Dmitracova, 2023, De Ruyter, 2023, Mathebula and Masiya, 2022). The need therefore arises to reduce the demand for electricity generated by Eskom on a national level, and for private property owners to invest in solar energy solutions which would provide them with more reliable energy supply and greater energy security (Mathebula and Masiya, 2022).

The following discussions provide a background to South Africa's energy landscape before setting out the regulatory framework applicable to solar PV energy in the country. Thereafter, the incentives and drivers of private energy generation are discussed.

1.2.1 South Africa's Energy Landscape

South Africa's energy model is heavily reliant on conventional power generation as conventional energy sources are considered attractive when compared to newer technologies (Sadek, 2022). The state-owned utility, Eskom, owns and operates all coal-fired power plants in South Africa, which supplies approximately 95% of the country's total electricity demand (Gretener and Dmitracova, 2023). The country's energy model is, however, inefficient and has led to rising costs of electricity, alongside the introduction of new and cost-effective technologies that lower carbon emissions and are capable of being decentralised (Poorun and Radmore, 2022).

Furthermore, the country's energy model has resulted in increased intensities of loadshedding, which is driven by factors such as delayed commissioning, underperformance of new-build coal generation capacity, ageing infrastructure, lack of maintenance, mismanagement and corruption within Eskom (Gretener and Dmitracova, 2023). The severe impact of frequent and prolonged periods of loadshedding has led to an energy crisis which has a detrimental impact on the country's economy (Mathebula and Masiya, 2022). Households or residential private property owners are impacted considerably as they are reliant on electricity for heating, cooking, and lighting (De Ruyter, 2023). Furthermore, businesses and industries or non-residential private property owners are impacted significantly as they are often forced to shut down operations which results in lost productivity and revenue (Sakeliga, 2022). This, in turn, leads to supply chain disruptions, delayed deliveries and increased costs for businesses (Sakeliga, 2022).

Overall, the impact of loadshedding is significant and is directly related to reduced economic growth, increased unemployment and poor investor confidence (Sakeliga, 2022). The South African economy reportedly grew by an estimated 2.5% in 2022 (Minister of Finance, 2023), however in January 2023, the South African Reserve Bank forecast only 0.3% economic growth for the year given the impact that loadshedding has on the economy (Smit, 2023). The country's official unemployment rate increased

to 31.9% in the third quarter of 2023 and is expected to remain exceptionally high due to the aforementioned low growth rate projections (StatsSA, 2023).

During the Budget Speech in February 2023, the government announced a debt relief arrangement with Eskom as well as an *"energy support package"* which essentially comprises two new tax incentives for private property owners – one each for residential and non-residential private property owners respectively. Along with the existing incentives, these additional incentives are aimed at encouraging private property owners to invest in renewable energy and to increase private energy generation (Minister of Finance, 2023). The City of Cape Town (CoCT) has subsequently announced further incentives for City-supplied customers. The CoCT is considered to be one of the leading municipalities in the country in combating loadshedding and ending the energy crisis by promoting private energy generation through the implementation of efficient processes and additional regulatory incentives. These incentives are discussed in more detail in Chapter 2.

The various incentives stemming from the energy crisis will possibly be short-lived, as the energy support package is only valid until 29 February 2024 for residential property owners and 28 February 2025 for non-residential property owners (Minister of Finance, 2023). Nonetheless, these incentives are considered beneficial as they promote the use of renewable energy in the private sector, especially in the form of solar energy. Whilst this will not only reduce the load on the national grid and aid in reducing power cuts, the use of renewable energy in the private sector could greatly contribute to the country's goal in achieving net zero carbon emissions by 2050 as per the Paris Agreement (Sadek, 2022). The South African Government signed the Paris Agreement in November 2016, whereby they agreed to achieve net zero carbon emissions by 2050 in an attempt to combat climate change (Sadek, 2022). South Africa therefore needs to move towards a more sustainable energy mix which will guarantee energy security through the diversification of the country's energy supply (Sadek, 2022, De Ruyter, 2023).

Renewable energy is expected to play a key role in South Africa's future energy systems. However, conventional energy sources such as coal is considered an attractive source of energy from a financial perspective and has historically contributed 80% and more of the country's energy supply (Sadek, 2022). South Africa is therefore

heavily reliant on conventional energy sources and is considered vulnerable given the possible implementation of climate change response measures by developed countries (Sadek, 2022).

1.2.2 Regulatory Framework for Solar PV Energy in South Africa

The current regulatory framework for solar energy, amongst other renewable sources, is governed by the National Energy Regulator of South Africa (NERSA) along with the Department of Mineral Resources and Energy (DMRE) (National Energy Regulator Act 40 of 2004). The Integrated Resource Plan (IRP) is one of the main regulatory instruments used to set out the country's electricity capacity plan which includes the country's energy mix and generation capacity targets. The IRP essentially provides a regulatory framework for renewable energy projects and contains capacity allocations for renewable energy technologies such as solar PV, as well as detailed decommissioning schedules of existing coal-fired plants (Integrated Resource Plan 2019).

Additional regulations and policies that support the development of solar energy in South Africa include the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), Municipal Electricity Distributors (MED), Small-Scale Embedded Generation (SSEG) and Net Metering Regulations.

Private property owners who generate solar PV energy can be categorised as SSEGs, with net metering regulations allowing residential and non-residential customers to sell surplus power generated back to the grid, which is subsequently credited on their electricity bill (Jacobo, 2022). This is better known as a feed-in tariff (FiT) mechanism, which provides a financial incentive for private property owners and empowers those with solar PV to counter shortfalls of electricity. This mechanism therefore reduces the need for additional electricity generation from non-renewable sources by enabling the integration of renewable energy into the grid (Barroso et al., 2015).

In order to feed electricity back into the grid, private property owners require grid-tied solar PV systems. This kind of installation is connected to the national electricity grid. The connection can either be directly to the grid, or through the property's internal wiring. The grid-tied feed-in PV system can have an export option, which means that

the electricity generated by the system is used at the property, but any surplus electricity is fed back into the national grid (CoCT, 2023c).

In addition to the FiT mechanism, the Government has removed a licensing exemption threshold in December 2022 to further incentivise private investments in renewable energy generation (Electricity Regulation Act 4 of 2006 Licensing and Exemption Registration Notice, 2021). Before this date, private property owners required licences for generation projects. Currently, they only need to be registered with NERSA and be compliant with the technical requirements to connect to the grid (Jacobo, 2022).

Nonetheless, the uptake of solar energy amongst private property owners in South Africa has been fairly slow over the past ten to fifteen years despite the existence of the mentioned regulations and policies. The need therefore arises for additional regulatory incentives and encouragement to private property owners to invest in solar PV systems (Jacobo, 2022).

1.2.3 Incentives and Drivers of Private Energy Generation

Increasingly, households, businesses and other private entities are using their own renewable energy systems to generate electricity, with solar panels being the most common system used (Integrated Resource Plan 2019). Private energy generation is fast becoming a popular way for private property owners to reduce their reliance on the national electricity grid and to address the current energy crisis in South Africa (Gretener and Dmitracova, 2023).

Although private energy generation would seem appealing to residential and non-residential private property owners, especially given the rapid increase in loadshedding over the past few years, this is often costly which deters private property owners to invest in solar PV systems (Xue et al., 2021). Solar PV systems for private energy generation bears a high initial investment cost and is possibly the greatest constraint for residential private property owners and smaller non-residential property owners. However, financing options have increasingly become available for private property owners to enable them to install solar PV systems (Omarjee, 2022).

Given the current economic climate and energy crisis, an increase in off-grid solar PV systems was noted which could be ascribed to erratic power supply, increasing electricity prices, remoteness of certain areas and the regulatory and technical

requirements associated with grid-tied systems (Gretener and Dmitracova, 2023, Jain and Jain, 2017).

As a regulatory response to the energy crisis and the growing trend of off-grid solar PV systems, the Government has made private energy generation and grid-tied solar PV systems more attractive and, in some cases, more economically viable. This is achieved by providing regulatory incentives such feed-in tariffs (FiTs), capital subsidies and tax benefits (National Energy Crisis Committee, 2022). Some municipalities such as the City of Cape Town, City of Johannesburg and City of Ekurhuleni Metropolitan Municipalities have shown an interest in further incentivising private energy generation, as they offer additional regulatory incentives as to what is offered on a national level (Poorun and Radmore, 2023). In addition to the benefits relating to regulatory incentives, the installation of solar PV systems is further motivated by drivers such as cost savings, energy security, environmental benefits, the availability of green-energy financing, and tenant retention by meeting tenant requirements (Eskom, 2020).

1.3 Problem Statement

The problem to be examined in this study may be stated as follows:

South Africa is experiencing severe electricity supply constraints which has adversely affected private property owners, as well as the country's economy. Since the onset of the energy crisis in 2007, various constraints (including regulatory and monetary barriers) came into existence for private property owners to install grid-tied solar PV systems. Given these constraints, private property owners were motivated to pursue off-grid solar PV systems.

The Government has recently enhanced the existing regulatory incentives for private property owners to assist them, along with the state-owned utility Eskom, in combating the energy crisis. The Government announced temporary regulatory incentives at the beginning of 2023 for private property owners to install private energy generation systems.

Various municipalities have followed suit and announced additional incentives for private energy generation, which is expected to promote the installation of grid-tied solar PV systems amongst private property owners. It is unclear whether the

abovementioned incentives are effective, and whether the move towards solar PV energy is driven by regulatory incentives or by other factors.

1.4 Research Questions

The research questions to be addressed may be stated as:

a) Which regulatory incentives exist for residential and non-residential private property owners to pursue solar PV systems?

b) What are the non-regulatory drivers that motivate private property owners to pursue solar PV systems?

c) To what extent are the regulatory incentives considered a determining factor for private property owners to pursue solar PV systems, when compared to non-regulatory drivers?

1.5 Research Proposition

The research proposition of this study may be stated as follows:

Despite the regulatory incentives introduced by government, private property owners are rather motivated by a variety of non-regulatory drivers to pursue solar PV systems.

1.6 Research Aim

The aim of this study is to determine which regulatory incentives and non-regulatory drivers exist for private property owners to pursue solar PV systems; and to investigate the influence these incentives and drivers have on private property owners in pursuing solar PV systems.

1.7 Research Objectives

The research objectives to be achieved are summarised below:

I. Determine which national and municipal regulatory incentives exist for private property owners to pursue solar PV systems.
II. Identify additional non-regulatory drivers that motivate private property owners to pursue solar PV systems.
III. Establish to what extent the regulatory incentives influence private property owners to pursue solar PV systems, when compared to non-regulatory drivers.

1.8 Research Methodology

There is limited qualitative data regarding the regulatory incentives and non-regulatory drivers that exist for private property owners to pursue solar PV systems. Therefore, the research methodology adopted in this study takes a qualitative approach founded on a single case study.

A literature review is conducted regarding South Africa's energy landscape, which frames the investigation of the national and municipal regulatory incentives and non-regulatory drivers. The City of Cape Town is the selected case study area. Empirical data is collected via semi-structured interviews with residential and non-residential private property owners, as well as solar practitioners in the Cape Town area. The aim of the interviews is to gain an understanding of the determining factors when private property owners consider the installation of solar PV systems. The data is analysed using thematic analysis. Lastly, conclusions are drawn and recommendations made.

1.9 Research Scope and Limitations

The scope of this research is limited to private property owners pursuing private embedded generation through solar PV systems in the residential and non-residential property sectors. The non-residential property sector comprises offices, retail, agricultural, and industrial properties. Large-scale power producers and wheeling of electricity is not included in this research study.

The area of research only focuses on the regulatory incentives and non-regulatory drivers relating to solar energy. Although some of these incentives or drivers could be applicable to other renewable energy sources, these sources are not considered for this research study.

Furthermore, the research is limited to a single case study based on the City of Cape Town Metropolitan Municipality area because this municipality creates a conducive environment through its legislative framework for private property owners to pursue private embedded generation systems. As a single case study is analysed, the results and findings may not be generalised across all areas of the country in a different context.

1.10 Structure of Report

The remaining chapters of this research report are structured as follows:

Chapter 2 comprises a literature review of the research topic and supplements the background provided in Chapter 1. The aspects discussed include the country's energy landscape, the current regulatory framework as well as the regulatory incentives and non-regulatory drivers related to private embedded generation.

Chapter 3 outlines the chosen research methodology and approach used in this study.

Chapter 4 reports on the findings from the empirical research and comprises an analysis of the interview data and a discussion of the findings to address the research questions, aim, and objectives.

Chapter 5 draws a concluding argument based on the previous chapters in this research report. The conclusion comments on the research results and provides answers to the research questions. It also proposes areas for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter examines the relevant literature relating to the research topic. The chapter provides context for the study, identifies gaps in the literature and explains how the research contributes to the field.

This chapter begins with an overview of South Africa's energy landscape, which includes the energy crisis, the drive for renewable energy and an outline of the various role players in the country's energy sector. Thereafter, the regulation of renewable energy in South Africa is discussed, followed by the regulatory incentives and non-regulatory drivers relating to the implementation of solar PV systems by private property owners. In terms of the regulatory incentives offered at a municipal level, this study is limited to the analysis of these incentives offered by the CoCT.

As indicated in Chapter 1, this dissertation only focuses on the regulatory incentives that are available to private property owners in the residential and non-residential property sectors who pursue solar PV systems for private embedded energy generation. This dissertation does not include a discussion on any other form of renewable energy generation or the wheeling of electricity.

For the purposes of this study, the non-residential property sector is used as an umbrella term that includes privately owned office, retail, agricultural and industrial properties. The term "solar PV systems" refers to grid-tied, rooftop solar energy systems consisting of solar panels and inverters only and excludes backup batteries. Backup battery systems do not form part of solar PV systems, as they are not used to generate power, and are not relevant to the regulatory incentives relating to private embedded generation or solar PV systems

2.2 Energy Landscape

This section gives context to the study by providing an overview of South Africa's energy crisis and the drive to renewable energy given the country's reliance on fossil fuels. Furthermore, this section outlines the various role players of South Africa's energy sector.

2.2.1 The Energy Crisis

South Africa is heavily reliant on conventional power generation, which represents over 80% of the country's generation capacity. From a financial perspective, conventional energy sources are considered attractive when compared to newer technologies (Sadek, 2022). All coal-fired power plants are owned and operated by Eskom, which supplies approximately 95% of South Africa's total electricity demand. The remainder is met through municipalities, imports and independent power producers (Poorun and Radmore, 2022).

Eskom is therefore mainly responsible for the generation, transmission and distribution of electricity in South Africa (Gretener and Dmitracova, 2023). Traditionally, a single operator model supports developing electricity markets. However, South Africa's dependence on such a model has decreased over the past decade. This comes as a result of the model's inefficiencies and rising costs of electricity, alongside the introduction of new and cost-effective technologies that lower carbon emissions and are capable of being decentralised (Poorun and Radmore, 2022).

In addition to the above, the country's energy model has resulted in increasing intensities of loadshedding, which has been driven by factors such as delayed commissioning and underperformance of new-build coal generation capacity, as well as the dilapidation of the existing coal fleet (Poorun and Radmore, 2022). Gretener and Dmitracova (2023) note that the dilapidation mainly occurs due to ageing infrastructure, lack of maintenance and lack of available funds. Additional factors include mismanagement and corruption in the state-owned utility company (Gretener and Dmitracova, 2023). Combined, these factors have led to declines in the Energy Availability Factor (EAF) and increasing levels of the Unplanned Capability Loss Factor (UCLF), which have a detrimental impact on the country's energy security (Poorun and Radmore, 2022).

The EAF is limited by planned and unplanned outages and is essentially the percentage of maximum energy generation that a plant can supply to the national electricity grid (Das et al., 2018). As seen in Figure 1, Eskom's EAF has decreased gradually from 2013 to 2015, with a slight increase noted in 2016 and 2017. During these two years, the country had not experienced a single day of loadshedding, which is evident in Figure 2.

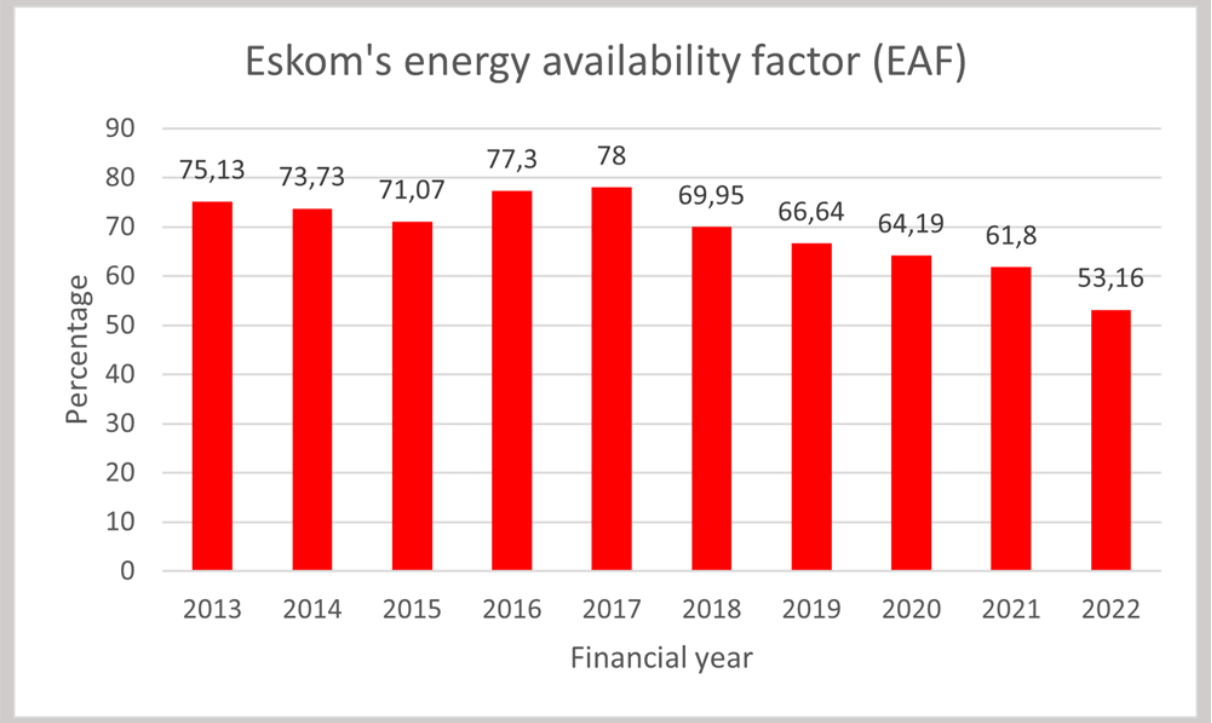

Figure 1: Eskom's Energy Availability Factor (EAF) (BusinessTech, 2022)

From 2018 onwards, the EAF has declined gradually on an annual basis, with a steeper decline from 2021 to 2022. Another steep decline would be expected from 2022 to 2023; however, the latest figures for 2023 were not available at the time of submitting this report. The severity of loadshedding has increased substantially since it was first introduced in 2007, and aligns with the decrease in EAF from 2018 onwards. This is evident from Figure 2, which provides a visual representation of the hours of loadshedding experienced per stage from the start of January 2015 to the end of May 2023.

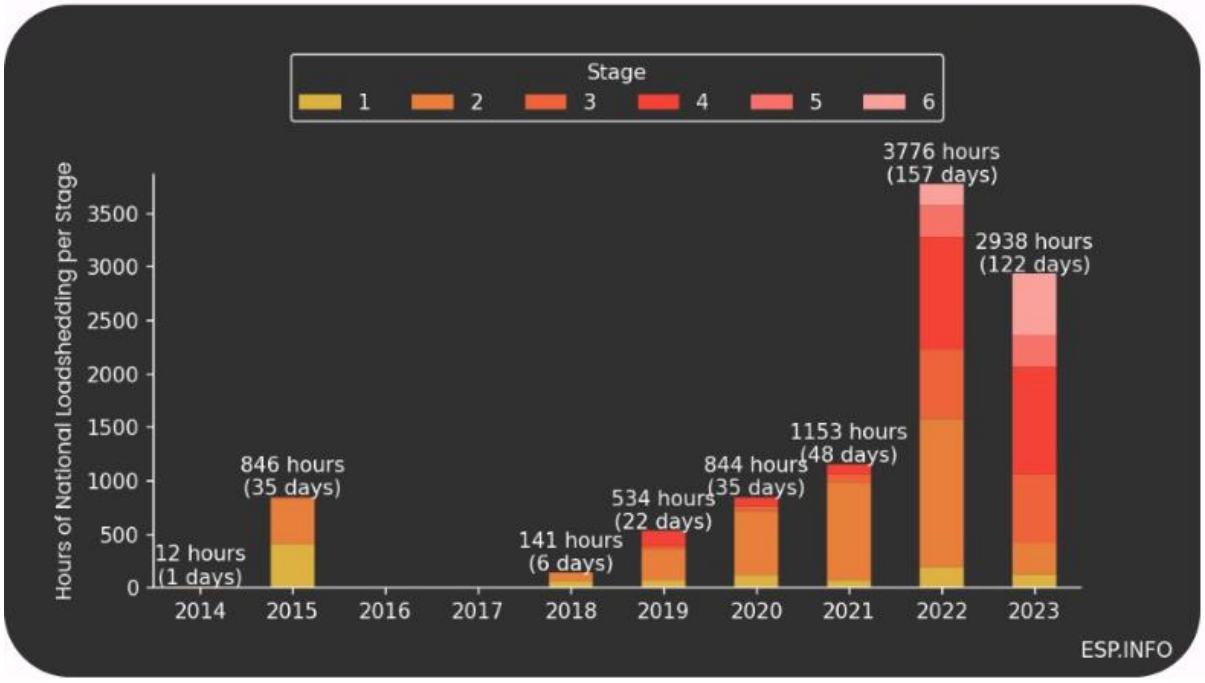

Figure 2: Increasing Levels of Loadshedding (ESP, 2023)

The number of days included in Figure 2 are not representative of the actual number of days that South Africans have experienced loadshedding, but are converted from the hours recorded per annum. South Africa has experienced a total of 186 days or 4,461 hours of loadshedding as at 31 July 2023, which far exceeds the total hours of loadshedding experienced in 2022. This also equates to an increase of 1,523 hours or 64 days over the three-month period from May 2023 to July 2023. Furthermore, weekly loadshedding is forecast by Eskom for the next year (Omarjee, 2023).

Frequent and prolonged periods of loadshedding effectively threaten economic growth and have led to an energy crisis in South Africa which affects both households and businesses (Gretener and Dmitracova, 2023). The current energy crisis has also led to the announcement of a national state of disaster in February 2023 (Disaster Management Act 57 of 2002 Declaration of a National State of Disaster: Impact of Severe Electricity Supply Constraint). However, the state of disaster was terminated two months later, on 5 April 2023 (Nkadimeng, 2023).

The greatest challenges for households during loadshedding periods include safety, security, and cooking whilst productivity is arguably businesses' greatest concern (Poorun and Radmore, 2023). Loadshedding has caused businesses to have even greater capital spending compared to households, as businesses need to purchase diesel generators (and fuel) to maintain operations in the short term. Generators are

generally considered relatively affordable to purchase. However, given the prolonged and frequent power cuts, the demand for fuel is high. Effectively, this makes generator systems expensive in the medium to long term (Weimar, 2023). High utility costs and fuel prices therefore cause private property owners to consider alternative energy solutions.

As seen in Figure 3, the cost of diesel has increased significantly from January 2021 to October 2023, and coincides clearly with the increase in loadshedding portrayed in Figure 2.

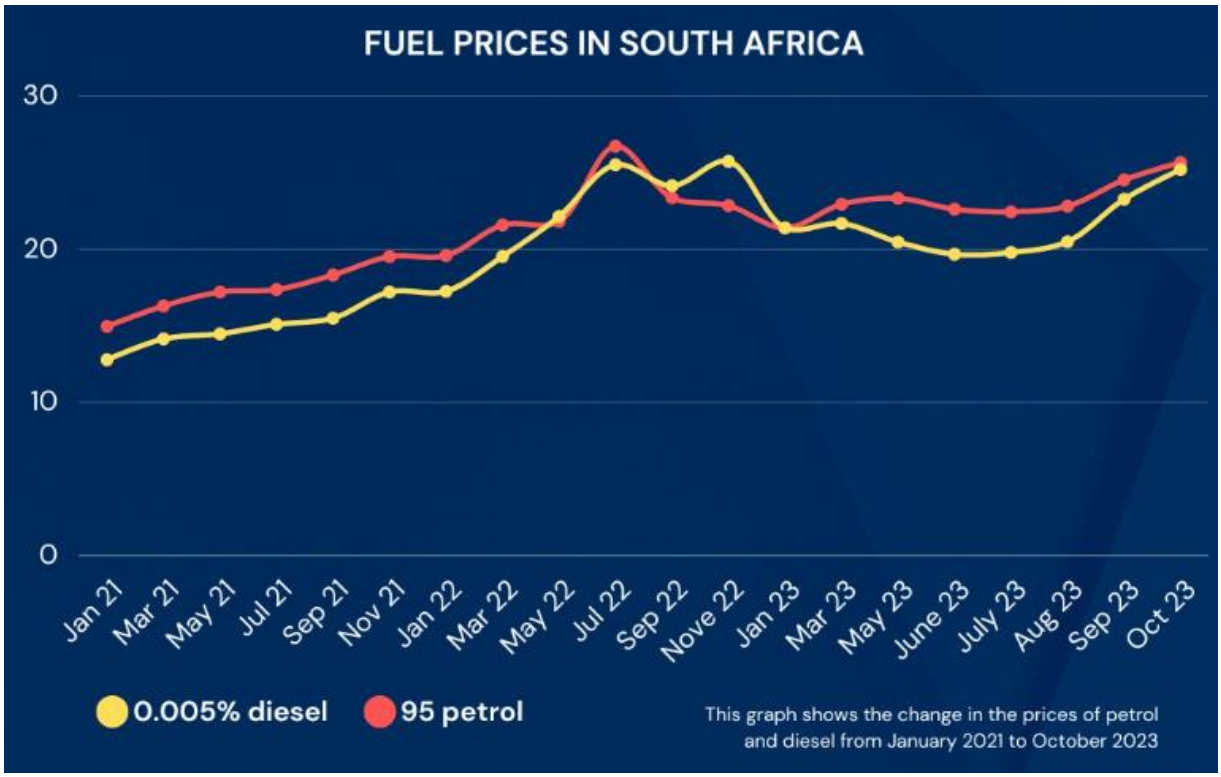

Figure 3: Fuel Prices in South Africa (BusinessTech, 2023a)

2.2.2 Drive towards Renewable Energy

According to Poorun and Radmore (2023), the renewable energy program in South Africa was halted in the past by corruption and criminality, whilst the maintenance of the existing coal fleet and grid infrastructure was neglected. This contributed to the decline in the EAF and increase in the UCLF as illustrated by Figure 1 in section 2.2.1, which essentially led to the roll-out of regulatory incentives to promote the implementation of renewable energy in the private sector (Gretener and Dmitracova, 2023). The roll-out of these incentives would not only aid in restoring energy security

by reducing the load on the national grid, but contribute to the country's sustainability goals (Poorun and Radmore, 2022).

The abovementioned impact of corruption necessitates the move towards a more sustainable energy mix in South Africa, given the state of the country's economy coupled with the energy crisis and coal-intensive energy sector. During the State of the Nation Address in February 2023, it was noted that rooftop solar PV systems play an increasingly important role in the country's efforts to restore energy security in the short term, hence the roll-out of additional temporary regulatory incentives aimed at private property owners (Smit, 2023).

Furthermore, as a party to the United Nations Framework Convention on Climate Change (UNFCCC), the South African government signed the Paris Agreement in November 2016, whereby they agreed to achieve net zero carbon emissions by 2050 to combat climate change (Sadek, 2022). In September 2021, the government issued an update to the first Nationally Determined Contribution (NDC) under the Paris Agreement which reflects the Government's "highest possible level of ambition…in light of our national circumstances" (Department of Forestry Fisheries and the Environment 2021).

The finalised targets of the NDC intend to limit greenhouse gas emissions by 2025, and even more so by 2030 (Poorun and Radmore, 2022). The temporary expansions to the regulatory incentives relating to rooftop solar PV systems are further discussed in section 2.4. Essentially, these include a rooftop solar rebate for residential private property owners and an increased tax benefit for non-residential private property owners. The regulatory incentives not only benefit private property owners but contribute to the country's sustainability goals due to the resultant increase in the uptake of solar PV systems.

The use of carbon-intensive energy sources in South Africa's energy sector is associated with various risks such as climate-, social-, physical- and transitional risks which need to be considered. This further emphasises the need to transition to a sustainable energy mix, which is expected to combat these risks. Given the lack of adequate new generation capacity, unplanned electricity outages are increasing which increases the use of diesel generators and releases additional greenhouse gas

emissions (The Presidency, 2022). This motivates the move towards the implementation of renewable energy systems amongst private property owners. Private property owners are further motivated by their desire to reduce their reliance on Eskom, which promotes the transition to a decarbonised energy sector (Weimar, 2023).

In terms of physical risks related to the carbon-intensive energy sector, the effects of global warming are expected to cause seaboard storms and recurrent intense fires and floods, as already experienced in South Africa in recent years (The Presidency, 2022, Igamba, 2023). These effects also pose a direct threat to the private sector in that it negatively impacts on municipal service delivery in areas where frequent disasters occur (Weimar, 2023).

Furthermore, carbon is embedded in South Africa's commodities and products, and the country's trade systems are therefore vulnerable to transitional risks related to the decarbonisation of the coal sector (The Presidency, 2022). The demand for South African commodities is also directly impacted by the decarbonisation efforts of trading partners, as well as the expected introduction of carbon border tax adjustments on South African exports. With these measures in place, more than 50% of South Africa's export value will be subject to carbon tax levies (Poorun and Radmore, 2023). The agricultural and industrial sectors contribute significantly to the country's exports and are greatly impacted by these transitional risks (Poorun and Radmore, 2023). Industrial and agricultural private property owners could avoid or reduce carbon tax levies by lowering their carbon footprint through the implementation of renewable energy or solar PV systems.

The risks mentioned above impact labourers, communities and businesses, and these interventions should therefore drive renewable technologies, which would support economic opportunities and promote industrial development and economic diversification. This would subsequently lead to a sustainable and economically resilient future, offering job opportunities, reduced poverty levels and social inclusion (Eskom, 2020).

Eskom introduced the Just Energy Transition Investment Plan (JET IP) concept in 2020, which encompasses the transformation of South Africa's energy system in a

socially, economically and environmentally reasonable and inclusive manner, whilst supporting the fossil-fuel industry workers in transitioning to new jobs and industries (Eskom, 2020). The JET IP concept recognises that the transformation to a sustainable and low-carbon energy system should not worsen the existing disparities such as access, distribution and benefits to vulnerable communities, but rather promote social justice and equality by protecting these communities against the impact of loadshedding as a result of the ongoing energy crisis (Eskom, 2020).

In the energy sector, the JET IP is mainly focused on managing the decommissioning of retiring coal power plants (in line with the IRP) whilst increasing renewable energy generation, strengthening the national transmission grid infrastructure and enhancing the electricity distribution system (The Presidency, 2022). The JET IP also recognises the opportunity to attract investors, diversify the country's energy mix and achieve energy security and climate resilience whilst addressing the issues mentioned above (The Presidency, 2022).

2.2.3 Role Players in South Africa's Energy Sector

Eskom, as the national power utility and the owner of the majority of electricity generation and transmission infrastructure in South Africa, is considered a key role player in the electricity sector, through which numerous government programmes are implemented. Municipalities may also generate electricity, but generally do so on a much smaller scale, and are responsible for a large percentage of electricity distribution in South Africa (Le Grange, 2019).

Various government departments guide the development of the energy sector, including the Department of Mineral Resources and Energy (DMRE) and the Department of Public Enterprises (DPE). These departments each play their own role, with the former being the custodian of energy policies and energy security in South Africa, and the latter being responsible for energy infrastructure for state-owned entities such as Eskom (Poorun and Radmore, 2022).

The development of the energy sector in South Africa is guided by national and local government with input received from various relevant industry bodies (Poorun and Radmore, 2022). On a national level, two key entities include the South African National Energy Development Institute (SANEDI) and NERSA. SANEDI can be

classified as an implementation entity which guides the uptake of energy efficiency projects and promotes green energy and energy efficiency in South Africa (Joemat-Pettersson, 2015). NERSA, on the other hand, can be classified as a government entity that regulates the electricity sector. Some of NERSA's responsibilities include licensing, registration, pricing and tariffs, compliance monitoring and dispute resolution (Poorun and Radmore, 2022). NERSA therefore issues licences for generation, transmission, and distribution (with conditions) to private entities. NERSA also sets the tariff guidelines and determines pricing structures on both a national and local government level. Private property owners therefore need to apply for a grid connection and register their private embedded generation systems with NERSA (Le Grange, 2019).

As mentioned previously, industry bodies also provide input into the development of the energy sector and often play a role in policymaking (Poorun and Radmore, 2022). Various industry bodies exist, and although these industry bodies share a similar purpose, they are all aimed at different markets within the renewable energy sector. The South African Photovoltaic Industry Association (SAPVIA) is the only industry body relating to solar energy (in conjunction with the South African Energy Storage Association) and represents the solar PV market in the country. SAPVIA essentially promotes solar PV generation and supports the socio-economic development targets of South Africa (Poorun and Radmore, 2022).

According to Poorun and Radmore (2023), there has been an upward trend of municipalities adopting private embedded generation processes over the past 5 years. This comes as a result of the national government and NERSA implementing regulations and tariffs which promotes the uptake of solar PV systems. Various municipalities have therefore made changes to their regulations, in line with those implemented by the government, which (when approved by NERSA) allows them to create an energy plan that does not exclusively rely on Eskom (Poorun and Radmore, 2022).

In addition, five metropolitan municipalities, including the CoCT, have taken the initiative to sell electricity to their customers that they have purchased directly from IPPs, thereby reducing the municipality's reliance on Eskom for generation purposes (Poorun and Radmore, 2022). South African municipalities are reliant on the sale of

electricity as a major source of revenue. Revenue collected in this way is used to fund other municipal functions (Weimar, 2023).

Furthermore, various local municipalities have started empowering businesses and households to generate, procure and sell their own power in an attempt to minimise the impact of the ongoing power cuts (Higham, 2020). Current legislation allows residential and non-residential private property owners to pursue private embedded generation systems by connecting to the grid and registering their solar PV systems with NERSA and the local municipality. In comparison to Eskom's lengthy application and commissioning process to connect to the grid, local municipalities such as the CoCT are making this process more efficient and appealing for their customers by streamlining the process (CoCT, 2023a).

2.3 Regulation of Renewable Energy in South Africa

This section examines the regulatory framework relating to renewable energy generation in South Africa and provides an overview of the governance and regulatory context of the case-study municipality, being the CoCT.

2.3.1 National Regulatory Framework

There is no overarching legal framework in place that relates to renewable energy, and this is currently dealt with in a disparate set of legal provisions in South Africa. The implementation of a piece of renewable energy legislation would demonstrate the viability of renewable energy sources and promote the application thereof, as well as aid in the transition to a more sustainable energy mix. The current legal provisions are discussed in more detail below.

Plans, Policies and White Papers

In terms of the country's (renewable) energy sector, the current regulatory framework is essentially shaped by the Integrated Energy Plan (IEP) and IRP and is supported by the White Paper on Energy Policy (1998), the Renewable Energy White Paper (2003) and the National Climate Change Response Policy White Paper (2011). The IEP takes a holistic perspective on the country's energy needs to project future energy requirements. A coherent energy plan is created which takes the entire energy system

into account and allows for the alignment and optimisation of the respective energy sources (Integrated Resource Plan 2019).

The IRP resulted from a shift that was introduced in the White Paper on Energy Policy (1998) for energy planning. This shift was influenced by the Renewable Energy White Paper (2003) which required the adoption of the IRP (White Paper on Renewable Energy, 2003). Before the shift, Eskom was responsible for the national planning function for electricity. However, the IRP provides an integrated approach which ensures that the various energy resources are treated fairly from a financial perspective to assess their performance and potential (Joemat-Pettersson, 2015). It was expected that the IRP would be updated during 2023, given the national energy security context and regulatory movement (Creamer, 2022). However, the updated IRP has not yet been released at the time of submitting this dissertation.

The major differences between the IEP and IRP are that the IEP takes the whole energy system into account. It is apparent that a sustainable energy system is one of its objectives, along with energy security, cost of energy, and access to energy. The IRP primarily provides a planning framework for the electricity sector and articulates electricity policy (Joemat-Pettersson, 2015).

Combined, the IEP and IRP provide guidance for energy planning and development as well as the integration of renewable energy sources such solar PV energy. These documents also affect and benefit private property owners pursuing solar PV energy as they influence regulatory incentives and support mechanisms, which include renewable energy targets, grid connections, as well as compliance with technological standards (Joemat-Pettersson, 2015). An enabling environment is effectively created for private property owners to pursue solar PV systems, as the IEP and IRP allow these systems to be more economically viable and environmentally sustainable, which is in line with the country's energy goals (Poorun and Radmore, 2022).

The National Energy Act 34 of 2008

South Africa's energy law is generally embodied by the National Energy Act 34 of 2008, which promotes integrated regulation and governance of the energy sector as a whole. The Act supports energy planning and the availability of diverse energy

sources and also promotes the increased generation and consumption of renewable energies (National Energy Act 34 of 2008).

This Act is administered by NERSA, which also enforces the national electricity regulatory framework and regulates electricity generated from renewable energy sources (Electricity Regulation Act 4 of 2006 Licensing and Exemption Registration Notice, 2021). The Act accounts for the collaboration of various economic sectors as well as environmental management requirements and supports the development of the IEP and SANEDI (Poorun and Radmore, 2022).

Private property owners pursuing solar PV energy must comply with the National Energy Act's provisions and abide by the regulations relating to grid connections, as the Act ensures that the energy generated by private property owners are in line with the country's goals and that it contributes to overall energy security. The Act may also include provisions to safeguard private property owners' consumer rights in the energy sector (Poorun and Radmore, 2022). Furthermore, the Act is beneficial to private property owners as it supports solar PV and other renewable energy sources and may support the development of additional incentives or support mechanisms for solar PV installations.

The National Energy Regulator Act 40 of 2004

The National Energy Regulator Act 40 of 2004 establishes a national energy regulator for electricity, gas and petroleum industries and for related matters (National Energy Regulator Act 40 of 2004). The Act provides a framework for renewable energy regulation. This Act operates alongside other legislation such as the Electricity Regulation Act (Act 4 of 2006), which regulates relevant industries. The National Energy Regulator Act allows NERSA to approve electricity tariffs and to issue, amend and revoke generation licences (Wing and Fontana, 2019).

The Electricity Regulation Act 4 of 2006

The Electricity Regulation Act 4 of 2006 establishes a national regulatory framework for the electricity supply industry and provides for the issuing of licences to generate, transmit, distribute, trade, import and export electricity (Electricity Regulation Act 4 of 2006 Licensing and Exemption Registration Notice, 2021). Schedule 2 of the

Electricity Regulation Act 4 of 2006 was amended in October 2021 to increase the threshold for private embedded generation. This was considered advantageous for private property owners, as the threshold was increased from 1MW to 100MW, meaning that a generation licence was not required up to 100MW. This threshold was removed completely in December 2022, which means that private property owners no longer have to acquire generation licences, and that their embedded generation systems only need to be registered with NERSA (Electricity Regulation Act 4 of 2006 Licensing and Exemption Registration Notice, 2021).

The removal of the threshold has motivated numerous private property owners to pursue solar PV systems due to the improved accessibility and reduced legal measures relating to private embedded generation (Poorun and Radmore, 2023). Apart from embedded generation systems having to be registered with NERSA, these systems also require approvals from the relevant distributors, such as the local municipality or Eskom, before connecting to the national electricity grid (Poorun and Radmore, 2023).

Carbon Tax Act 15 of 2019

The Carbon Tax Act 15 of 2019 came into effect on 1 June 2019 and is implemented in two phases. The first phase ended on 31 December 2022 with phase 2 being implemented from 2023 to 2030 (Carbon Tax Act 15 of 2009). Phase 1 included a relatively low tax rate per tonne of carbon dioxide emitted with a range of tax-free thresholds that was used to incentivise large emitters to decrease their carbon profile before the start of phase 2 (Poorun and Radmore, 2022). Phase 1 had no impact on electricity prices and therefore no resultant impact on landowners' utility bills.

Changes to rates and tax-free thresholds are applied in phase 2, which became effective from 1 January 2023 and affects businesses with high fuel and electricity consumption. Carbon tax for solar PV and other renewable energy sources are yet to be determined but are good sources for carbon offsetting (Poorun and Radmore, 2022). To endorse South Africa's COP26 obligations, the National Treasury has increased the carbon tax rate in February 2022, and will continue to increase this rate annually to beyond 2050 (Poorun and Radmore, 2023).

In general, the Carbon Tax Act may lead to an increase in operating costs for businesses who rely on energy-intensive processes. When viewed from a different perspective, the implementation of green practices such as the installation of solar PV systems may reduce the property owner's carbon tax liability.

2.3.2 Regulatory Context of a Leading Municipality

Provincial and local governments' options are generally limited in terms of reducing or minimising the effects of loadshedding, as Eskom currently has a 'monopoly' on national electricity generation and supply. Notwithstanding this, various provinces are working towards reducing their reliance on the national utility, and are taking an alternative approach to provide energy security to households and businesses and to maintain economic growth on a provincial level (Higham, 2020). Municipalities are also working towards enabling private property owners to generate electricity through solar PV installations, and for them to feed surplus energy back into the electricity grid (Higham, 2020).

The Western Cape government is supporting municipalities to promote private embedded generation through their Energy Resilience Plan, which aims to reduce the effect of loadshedding on businesses and households (Thaw, 2023). As a result, municipalities within the Western Cape benefit from regulations that enable them to generate, procure and sell their own electricity, which increases energy security in the province (Thaw, 2023).

The Western Cape provincial budget speech was held on 14 March 2023, in which the Western Cape Minister of Finance and Economic Opportunities, Mireille Wenger, outlined the provincial government's priority spending plan for the year. Emphasis was placed on the current energy crisis. In response, the provincial government has allocated a total of R1.1 billion to combat the crisis and increase the province's energy security (Wenger, 2023). This allocation enables the realisation of the objectives forming part of the province's Energy Resilience Plan.

The budget speech also emphasised the development of the Western Cape Integrated Resource Plan relating to generation and financing planning. This provides policy certainty and a cost plan for new energy generation in the province (Wenger, 2023). Furthermore, a budgetary provision is allocated to aid municipalities in piloting

renewable energy solutions and creating municipal energy master plans (Wenger, 2023). The Western Cape government's commitment to combatting loadshedding and increasing energy security in the province is clearly communicated in 2023's budget speech. Although the provincial government does not offer any incentives for reducing grid demand, they enable and support municipalities to put measures in place that benefit residential and non-residential private property owner that pursue renewable energy solutions.

In terms of private embedded generation uptake, the Western Cape leads with twenty-four municipalities that allow for these installations, followed by nine municipalities within the Northern Cape. The Western Cape also leads with eighteen municipalities that offer NERSA-approved FiTs, compared to three in the Northern Cape (Poorun and Radmore, 2022). These municipalities within the Western Cape are identified in Figure 4.

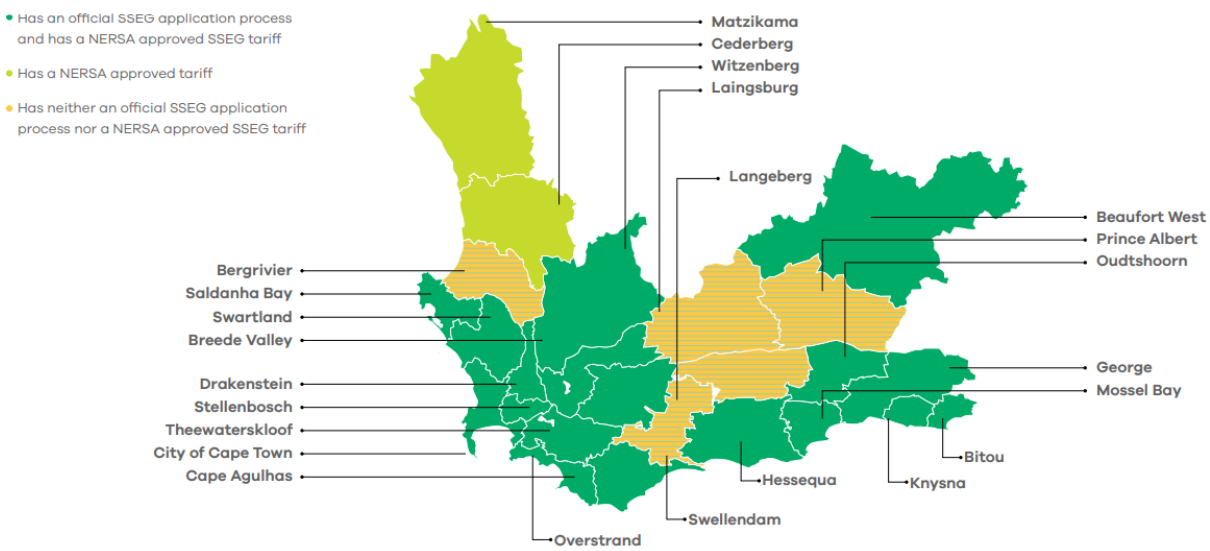

Figure 4: Western Cape Municipalities that Allow Grid Connection and Offer Feed-In Tariffs (Poorun and Radmore, 2022:30)

Compared to the other provinces, the Western Cape accounts for approximately 35% of municipalities that allow small-scale embedded generation installations, and 58% that have approved FiTs in place (Poorun and Radmore, 2023). The Western Cape government plays a crucial role in managing the electricity crisis in the province and is, through their budgetary allowances, enabling municipalities within the Western Cape to compensate businesses and households for installing rooftop solar PV systems and feeding excess electricity back into the grid (Higham, 2020).

The Western Cape is supportive of energy policies and regulations for private energy generation, and accounts for approximately 25% of the national embedded generation rooftop PV footprint (Weimar, 2023). In terms of private embedded generation installations, municipal regulations that complement the national legislative framework creates conducive market conditions for various stakeholders, which impacts market growth as well as investment and employment opportunities (Poorun and Radmore, 2022).

On a local government level, the CoCT is supportive of private energy generation and distribution, as the municipality has amended its regulations to encourage investment in private embedded generation. The municipality aims to end loadshedding over time as part of its Climate Change Strategy of 2021. This commitment is evident, as the municipality had more than 2,600 approved grid-tied installations by the end of 2022 (CoCT, 2023b).

The CoCT is considered to be at the forefront of becoming less reliant on Eskom for generating electricity and offers the greatest regulatory incentives of the Western Cape's municipalities for private energy generators. These incentives generally differ for non-residential and residential properties and are discussed in more detail in subsections 2.4.1 and 2.4.2 below.

2.4 Regulatory Incentives Available for Private Energy Generation

The framework discussed in section 2.3 above provides an overview of the regulatory landscape and the applicable legislative provisions that govern the renewable energy sector in South Africa. These provisions promote private embedded generation through regulatory incentives, especially in terms of solar PV energy generation, which is considered a viable and versatile renewable energy source for private property owners.

This section analyses the regulatory incentives that are available to private property owners located in the CoCT to pursue private embedded generation by utilising solar PV systems. The discussion of incentives is divided into two main categories. The first category focuses on regulatory incentives applicable to non-residential property owners. The second category relates to regulatory incentives available to residential property owners.

In terms of the incentives offered by the CoCT, it is important to note that Eskom-supplied customers within the CoCT's metropolitan boundary cannot benefit from any of the incentives offered by the municipality, and have to abide by Eskom's rules and processes (CoCT, 2023a). The CoCT plans to take over the whole distribution network within its municipal boundaries in the medium to long term which would allow these properties to benefit from the CoCT's initiatives (Weimar, 2023).

Furthermore, this section discusses the temporary incentives that were introduced in February 2023 to promote the use of renewable energy in the private sector (Minister of Finance, 2023). The incentives are expected to reduce the load on the national electricity grid and aid in reducing power cuts, which is expected to aid in restoring energy security (Minister of Finance, 2023, Stoddard, 2023).

2.4.1 Regulatory Incentives Available to Non-Residential Property Owners

A number of regulatory incentives are available to non-residential property owners pursuing solar PV energy generation. These incentives are largely driven by the national government, with additional incentives offered at municipal level by the CoCT. The incentives available to businesses or non-residential property owners include FiTs and a tax incentive in the form of a capital allowance. These two incentives are discussed below.

Feed-in Tariffs

As introduced in Chapter 1, net-metering regulations allow businesses to sell the surplus power they generate back to the grid, which is subsequently credited to their electricity bill (Jacobo, 2022). This is essentially a FiT mechanism and is one of the incentives available to non-residential property owners generating electricity through grid-tied solar PV systems. Investing in a solar PV system and selling electricity back to the grid provides a saving on a property owner's utility bill, which aids in offsetting the initial investment costs of these systems (Weimar, 2023). At this stage, FiTs are only implemented by certain municipalities, as indicated in Figure 4, and is not yet available as a national incentive.

There are certain requirements that must be met by private property owners in order to sell electricity back to the grid and benefit from the FiT incentive. Apart from private

embedded generation systems having to be registered with NERSA, these systems also require approvals from the relevant distributors, such as the local municipality, before connecting to the grid (Poorun and Radmore, 2023). Furthermore, businesses and households need to have an approved metering system installed. This system consists of advanced metering infrastructure which is installed by the municipality and accurately reports the customer's electricity consumption and generation (Burger, 2023).

Although Eskom-supplied customers nation-wide cannot currently benefit from FiTs, they still need to register their grid-tied solar PV systems with NERSA. This is a lengthy process which involves converting to a time-of-use (TOU) tariff, conducting a capacity study, paying a quotation fee to Eskom and providing proof of registration with NERSA to Eskom (Eskom, 2023a). In addition, once the grid connection application is approved, an Embedded Generation Installation (EGI) compliance test report must be submitted along with a Certificate of Compliance (CoC) for the wiring of the installation, an inverter certificate and the NERSA registration certificate (Eskom, 2023a).

During the budget speech in February 2023, it was stated that Eskom is in the process of developing a FiT for residential and non-residential customers. The potential costs associated with feeding electricity back into the grid as an Eskom-supplied customer will include a service and administration charge, a R/kVA/month transmission network or distribution network capacity charge and a R/kVA urban low voltage subsidy charge (Eskom, 2023b). When viewed over the period of a year, for example, the net benefit of feeding back into the grid is minimal (when this option becomes available), as the charges outweigh the potential savings generated by the FiT incentive (Werner and Ackermann, 2021).

Although private embedded generation systems do not require generation licences, CoCT-supplied customers are required to apply to the municipality for a grid connection and register their systems with NERSA (Poorun and Radmore, 2022). The supporting documents are not nearly as time-consuming to compile, and the overall process is considered to be more streamlined and user-friendly than that of Eskom (Burger, 2023).

The CoCT municipality received an exemption from the National Treasury regarding FiTs. This allows the municipality to provide grid-tied customers with a NERSA-approved FiT (CoCT, 2023b). The CoCT therefore offers non-residential private property owners a FiT of 73.87c/kWh, for which they received approval from NERSA for the 2023/2024 financial year (CoCT, 2023b). The CoCT offers an additional incentive of 25c/kWh to CoCT-supplied non-residential customers to feed electricity back into the grid. This additional incentive was implemented in June 2023 and is expected to have a positive impact on the uptake of private embedded generation systems (CoCT, 2023b).

Capital Allowance: Section 12B of the Income Tax Act 58 of 1962

The Income Tax Act provides an incentive for businesses in the form of a capital expenditure deduction for assets used in the generation of renewable energy. This provision is found in Section 12B of the Act (Income Tax Act 58 of 1962).

In February 2023, the budget speech introduced a change in the tax deduction offered in terms of Section 12B. Prior to the budget speech, a distinction was made between non-residential property owners (taxpayers) generating less than one megawatt and those producing more than one megawatt of solar PV energy (BVSA, 2022). A 100% income tax deduction in the first year of use was available to businesses generating less than one megawatt of solar PV energy. This deduction included the capital cost and direct cost of the installation of solar PV units, which were carried over to the following financial year as a deferred tax asset (Werner and Ackermann, 2021). This reduced the income tax liability as new solar power systems could be deducted as a depreciation expense. The deductible capital costs included photovoltaic solar panels, AC inverters, DC combiner boxes, racking, cables and wiring (BVSA, 2022).

In comparison, the income tax deduction for businesses generating more than one megawatt of photovoltaic solar energy provided for a 50%, 30%, 20% deduction respectively over a three-year period. This meant that 50% of the capital cost were deducted in year one, followed by 30% in year two and 20% in year three (BVSA, 2022). This also included any improvements (and excluded repairs) of the qualifying plant or machinery. This incentive provided a major cash flow benefit in the first three years of a project (Werner and Ackermann, 2021). Regardless of the amount of energy generated, this capital allowance incentive was only applicable if the asset was

brought into use for the first time by the taxpayer / private property owner (BVSA, 2022).

During the Budget Speech in February 2023, it was announced that Section 12B will be expanded for a temporary period of two years, until 28 February 2025 (Minister of Finance, 2023). This expansion is introduced by a proposed amendment to the Income Tax Act to include a new Section 12BA. The expansion is effective from 1 March 2023 and removes the abovementioned thresholds on generation capacity in an attempt to stimulate investment in renewable energy sources in the short term (Taxation Laws Amendment Bill B36 of 2023:cl16). This provides businesses (generating less than and more than 1MW) with the opportunity to reduce their taxable income on the cost of the investment by 125% in the first year. This temporary incentive therefore provides a greater saving for businesses or non-residential property owners compared to the structure of the incentive prior to March 2023. It is noted that this incentive is still only applicable if the asset is brought into use by the taxpayer / property owner for the first time.

In addition to the above, the Western Cape government has called for the Section 12B tax incentive to be increased from 125% to 140% (Winde, 2023). Reduced fuel levies or a tax break on diesel used to produce electricity is also being pushed by the provincial government, which would especially benefit businesses that are trying to maximise productivity levels during loadshedding. This could also greatly benefit businesses, as generators are still required (in the absence of expensive battery storage systems) to use electricity that is generated by solar PV installations during power cuts (Winde, 2023).

It is worth noting that Section 12L of the Income Tax Act forms part of a government program that provides a tax incentive to private property owners who invest in energy-efficient technologies. This allows property owners and developers to claim a tax deduction when reducing their overall energy consumption through the implementation of energy efficiency measures (BVSA, 2022). This incentive, however, falls outside the scope of this dissertation, as it is not directly related to the implementation of solar PV systems.

2.4.2 Regulatory Incentives Available to Residential Property Owners

Various regulatory incentives are also available to residential property owners pursuing solar PV systems. The regulatory incentives available to residential property owners include FiTs and a rooftop solar rebate.

Feed-in Tariffs

As mentioned previously, FiTs are not currently available to Eskom-supplied customers. The process of connecting to the grid as an Eskom customer is considered tedious and costly, especially by residential private property owners. Many private property owners are therefore reluctant to apply for grid connection of their solar system due to the administrative burden it places on them (Weimar, 2023).

FiTs provide CoCT-supplied customers with the opportunity to counter power cuts, decrease their carbon footprint and save on their utility bills. In terms of the residential property sector, the CoCT received approval from NERSA to implement a residential FiT of 78.98c/kWh for the 2023/2024 financial year (CoCT, 2023b).

No additional incentive is currently available for residential customers, however, the CoCT plans to extend the additional incentive of 25c/kWh to its residential customers by the end of 2023 (CoCT, 2023b). The additional incentive is expected to increase the uptake of solar PV systems in the residential property sector. However, given the high cost of living, residential private property owners can often only afford to install solar PV systems that match their demand for electricity or alternatively, install a backup battery system instead (Schulte et al., 2022).

Rooftop Solar Rebate: Temporary Expansion to the Income Tax Act 58 of 1962

During the budget speech in February 2023, the Minister of Finance announced that individuals or households are able to claim an income tax rebate of 25% of the cost of rooftop solar panels from 1 March 2023 to 29 February 2024 (Minister of Finance, 2023). This rebate allows individuals to reduce their tax liability in the 2023/24 tax year only, with the maximum rebate amounting to R15,000 (Minister of Finance, 2023).

This rebate only applies to solar panels that are purchased for and installed at a private residence and requires a certificate of compliance for the installation thereof. The

rebate is only valid for one year and is not applicable to portable solar panels, inverters, batteries or other energy storage systems in order to promote additional energy generation (BusinessTech, 2023b).

In the residential sector, solar panels are mostly installed with an inverter and are, in most cases, coupled with backup batteries. Given the high initial cost related to installing rooftop solar systems in the residential sector, the rebate is very low and provides no real incentive for residential property owners to pursue rooftop solar systems. The restrictions mentioned above, along with the limited rebate, generally negates this incentive (Schulte et al., 2022). The Western Cape government has called to extend the period of the income tax rebate for rooftop solar for residential properties, and to increase this rebate from a maximum of R15,000 to R40,000 (Winde, 2023). National Treasury addressed these criticisms in a response document in October 2023 (Draft Revenue Laws Amendment Bill, 2023).

According to the Draft Revenue Laws Amendment Bill (2023), it was commented that the one-year duration of the rooftop solar rebate is insufficient, as households require more time to plan, save and have the solar PV panels installed. The legislative process also takes nearly a year to complete. These comments were rejected by Government, as the timeframe is expected to incentivise additional generation by households.

Regarding the monetary limitation, it was commented that the cap on the rooftop solar rebate should be removed or increased. This was also rejected as the Government considers the current cap to be significant to taxpayers, and that the value of the installation represented by the cap is fiscally responsible (Draft Revenue Laws Amendment Bill, 2023).

As with non-residential property owners, residential property owners who invest in energy-efficient technologies can also benefit from Section 12L of the Income Tax Act. Residential property owners are able to claim a tax deduction when reducing their overall energy consumption through the implementation of energy efficiency measures (Stoddard, 2023). Due to the lengthy and costly verification process of this incentive, residential property owners often do not complete the process. This incentive falls outside the scope of this dissertation, as it is not directly related to the implementation of solar PV systems. Therefore, it is not discussed in further detail.

2.5 Non-Regulatory Drivers Related to Private Embedded Generation

Five major drivers can be identified in the literature that are currently motivating private property owners to pursue solar PV systems. These drivers include environmental considerations, cost savings, energy security, tenant requirements and green-energy finance (Poorun and Radmore, 2022, Creamer, 2022). Combined, these drivers create noteworthy opportunities for investors, businesses and households alike (Nedbank, 2023)..

2.5.1 Environmental Considerations

Various environmental benefits are associated with the increased implementation of solar PV systems. The generation of electricity through solar PV systems reduces the total amount of greenhouse gas emissions, which minimises pollution, aids in decarbonisation, improves health and well-being and increases sustainability (Hansen et al., 2013, Poorun and Radmore, 2022).

Environmental considerations are considered one of the major drivers that are motivating private property owners to pursue solar PV systems (Poorun and Radmore, 2022, Creamer, 2022, Nedbank, 2023). This is especially true for non-residential private property owners in the industrial and agricultural sectors as the implementation of renewable energy sources reduces the potential impact of carbon tax levies on businesses (Hansen et al., 2013).

In addition to the above, listed funds or Real Estate Investment Trusts (REITs) have large property portfolios, which includes both residential and non-residential properties. These funds or trusts are obligated by their investors to report on their environmental and social governance (ESG) performance as this demonstrates a commitment to responsible governance and forward-thinking decision-making (Tiwari, 2023). REITs and other listed funds are therefore motivated either to acquire properties with a green building certificate, such as the Green Star Certificate which is awarded by the Green Building Council of South Africa, or attain this certification on existing buildings by pursuing solar PV energy, for example (Green Building Council South Africa, 2023).

2.5.2 Cost Savings

Electricity prices in South Africa have been increasing rapidly over the past few years. As noted in Figure 5, there is a clear inflexion point for electricity tariffs from the 2008 electricity crisis onwards. Eskom's tariffs were generally lower than inflation during the 1990s and early 2000s, as the government kept these tariffs as low as possible to accommodate poor communities, especially since the state-owned utility had an oversupply of electricity. Eskom's tariffs exceeded inflation for the first time following the electricity crisis in 2008 and have quadrupled over the past 14 years (Moolman, 2022).

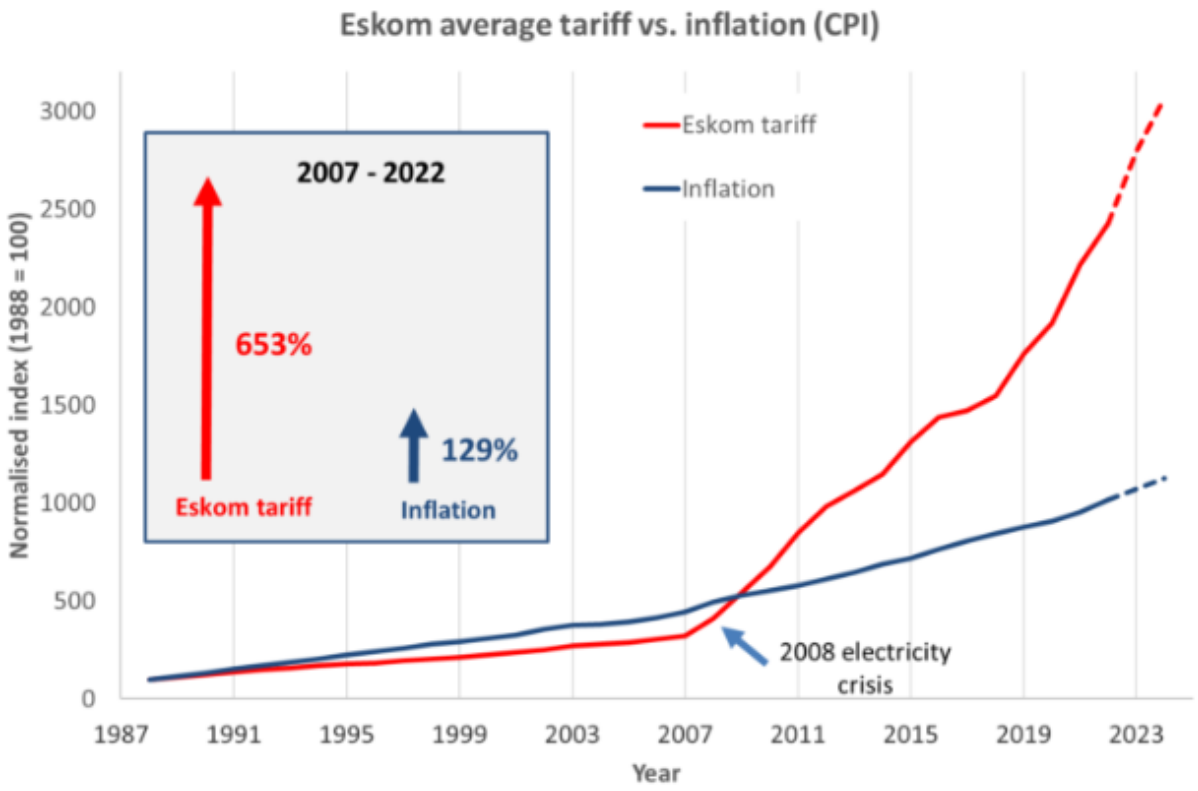

Figure 5: Eskom Tariff Increases versus Inflation Since 1988, with Projections to 2024 (Moolman, 2022)

As forecast in Figure 5, Eskom predicts further double-digit price increases in the coming years. Rising electricity prices create a strong business case for private property owners to invest in renewable energy solutions (such as solar PV), as this provides resilience to tariff hikes (Poorun and Radmore, 2023).

Solar PV currently dominates the private embedded generation market as a result of its competitive prices, favourable weather conditions, technical maturity and simple

implementation (Creamer, 2022). Renewable energy as a driver for transforming South Africa's energy sector, specifically in terms of solar PV, is two-fold.

Firstly, although solar PV systems have high initial costs, they have become economically viable for residential and non-residential property owners. This is due to the reduction of payback periods for self-consumption systems given the high cost of electricity (Poorun and Radmore, 2023). Private property owners can also benefit from installing solar PV as this allows them to save on their electricity bills.

The installation of solar panels is tax deductible in South Africa, as discussed in more detail in Section 2.4. Furthermore, CoCT-supplied customers who install a grid-tied solar PV system and sell electricity back to the grid can earn a rebate against their electricity bill. This allows for a cost saving in addition to the amount saved by reducing their electricity usage (Ukonlola et al., 2019).

2.5.3 Energy Security

Energy generation via a solar PV system (coupled with a generator or battery storage) allows private property owners to continue powering their buildings or operations during power cuts in the day. It is important to note that inverters require power to convert solar panels' direct current (DC) into alternating current (AC) and therefore needs to be connected to a power source such as a generator or battery system during periods of loadshedding (Schulte et al., 2022, Poorun and Radmore, 2023). Coupling a generator with the solar PV system allows property owners to use solar energy during the day while there is loadshedding.

In comparison, battery systems also fulfil this function but provide backup power when the sun is not shining. The combination of solar PV systems coupled with a generator or backup battery system therefore provides private property owners with greater energy security than conventional sources and allows them to be self-sufficient (Schulte et al., 2022). However, the focus of this dissertation does not include battery storage.

2.5.4 Tenant Requirements

As mentioned previously, a rooftop solar PV system reduces the electricity consumed from the grid which, in turn, reduces the cost of electricity and therefore provides a

saving on the property's utility bill. In both the residential and non-residential property sectors, utility costs are typically paid by the tenants.

The implementation of a solar PV system is often a requirement from the tenant, especially in the non-residential property sector. The reason being that it offers the tenant a saving on their operating costs and provides them with energy security, as they typically connect these systems to a generator (Sakeliga, 2022). Solar PV systems also allow tenants or businesses to lower the potential impact of carbon taxes, which would otherwise lead to an increase in operating costs for businesses who rely on energy-intensive processes (Creamer, 2022). Landlords or private property owners who install solar PV systems can also mitigate rising energy costs for their tenants and are, therefore, more likely to retain their tenants (Nedbank, 2023). The same applies to private property owners who own green certified buildings, as the existing energy efficiency measures reduce operating costs (Green Building Council South Africa, 2023).

2.5.5 Green Energy Finance

Commercial banks have started providing tailored finance solutions for rooftop solar PV investments over the past three to five years with specific portfolios supporting private embedded generation projects (Poorun and Radmore, 2023). These tailored solutions are aimed at solar PV installations in both the residential and non-residential markets, covering 70% to 100% of capital costs with a five- to ten-year loan repayment period (Poorun and Radmore, 2022, Nedbank, 2023). The loan repayment period is short, and private property owners are able to earn high returns on their investments (Weimar, 2023). Green-energy finance is therefore considered one of the main drivers for implementing private embedded generation systems as financing renewable energy solutions has become imperative given the growth of this sector over the past decade.

2.6 Chapter Summary

It is evident that the current energy crisis has a negative impact on economic growth. Although solar PV systems prove to be more sustainable and can reduce the demand for electricity generated by Eskom, there is a high initial investment cost to private property owners who wish to install these systems. The high initial cost acts as a

barrier to the uptake of private embedded generation. Therefore, it is imperative that private property owners (and the private sector in general) are incentivised, as this will aid in reducing power cuts, improving energy security, and allowing the country to move to a more sustainable energy mix. It is evident that the private sector is part of the solution to end the energy crisis and help the country achieve its net-zero carbon goals.

The regulatory incentives that are available on a national and local government level differ for residential and non-residential property owners. The national incentives, such as the tax deductions, are mostly oriented towards, and are more viable for, non-residential property owners. The municipal incentives offered by the CoCT, however, are very similar in both the residential and non-residential sectors and benefit both sectors equally. The CoCT encourages the move to a more sustainable energy mix, and will likely implement additional incentives in the near future. Although there may be differences in the policies and incentives on a national and local government level, these are considered to aid in driving transformation in the country's energy sector.

The regulatory incentives, especially in the residential sector, is often not sufficient to convince private property owners to install solar PV systems. In addition to the regulatory incentives, non-regulatory drivers such as environmental considerations, cost savings, energy security, tenant requirements and energy finance have been identified. These drivers encourage both residential and non-residential private property owners to pursue private embedded generation through solar PV systems, although to varying degrees.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

A systematic approach needs to be followed to solve the research problem set out in Chapter 1 of this report. Various research methodologies exist and are relevant to certain types of research techniques. It is important to reflect the methodology used to meet the research aims and objectives of this report.

This chapter identifies the research approach used in this study. It also provides an overview of the research strategy, design and data collection methods employed. Furthermore, this chapter discusses the ethical issues, reliability and validity of the data and any limitations relevant to this study.

3.2 Philosophical Framework

According to Saunders et al. (2019), research philosophy can be described as a collection of ideas and opinions concerning the development of knowledge. Assumptions are generally (and oftentimes intuitively) made at every stage in research and include the following: ontological assumptions (referring to the realities encountered in the research), epistemological assumptions (relating to human knowledge) and axiological assumptions (indicating the degree that one's own values influence the research process) (Saunders et al., 2019). These assumptions go hand-in-hand and effectively give rise to the methodology used. The choice of the method used to achieve the desired outcome is linked to the strategy and process that underpins it.

The philosophical framework informs the selection of a research approach and methods chosen as part of the research strategy when it is adopted effectively (Saunders et al., 2019). It is essentially a comprehensive theoretical concept that establishes the limitations of scientific research (Crotty, 1998).

There are essentially two approaches to research, consisting of a quantitative and qualitative research approach. The mixed-methods approach can also be utilised and comprises a combination of the two approaches. A positivist philosophy allows for a quantitative research approach, which is mainly concerned with the measurement of

a quantity or amount where the result of this approach is a number or a set of numbers, and is often presented in tables or graphs (Rajasekar et al., 2013).

In comparison, an anti-positivist or interpretive philosophy allows for a qualitative research approach. This is a descriptive form of research that applies reasoning by describing and realising the meaning of a situation (Abawi, 2008). The results of this approach are not presented in tables or graphs as there are generally no predetermined variables. This philosophy rather investigates *"how"*, *"why"* and *"in what way"* decisions are made (Rajasekar et al., 2013). The interpretive philosophy has been followed in this dissertation as it allows for a qualitative research approach.

3.3 Research Approach– The Qualitative Method

The qualitative research method is implemented in this study. This method or approach deals with subjective data produced by respondents or interviewees and is considered flexible and exploratory compared to the quantitative method, as the data can be changed to gain a deeper and more holistic understanding of the investigation (Welman et al., 2005a). An understanding is also derived from words and images, rather than numbers. These words and images are generally clarified with participants in the research process through interviews.

The qualitative method is appropriate to implement in this study as there are various elements that require a discussion between the interviewer and the respondents. The majority of the questions are do not have clear-cut answers, as with most quantitative studies, and participants should be able to express themselves when justifying their answers.

3.4 Research Design – Single Case Study

The research strategy or design is the plan that the researcher follows to collect data and answer their research question. Various research strategies or designs exist, with some more suitable to either the quantitative or qualitative research methods. The survey and experiment strategies are best suited for quantitative research methods, whereas the case study and ethnography strategies are best suited for qualitative research methods. This research utilises a case-study design, as it recognises the dynamics of the research topic within its context.

3.4.1 Overview

Case-study research draws on data from various sources to generate insights into the study of a phenomenon. This type of research design can therefore be used for descriptive, exploratory or explanatory purposes and aids in achieving insights into what is happening and why, and to recognise the meaning(s) of the situation (Saunders et al., 2019). A case may refer to a person, group, business, association, or event, and by understanding the dynamics of the topic, reference is made to the interactions between the case study and its context (Saunders et al., 2019).

Case-study research primarily consists of single case studies or multiple case studies. A multiple case study may produce more evidence as it incorporates multiple cases, however, the purpose of each approach is different (Saunders et al., 2019). A single case study may also be chosen in a unique or critical case.

This research project comprises a single case study of a specific municipal jurisdiction, namely the City of Cape Town Metropolitan Municipality (CoCT). The research undertaken focuses on the regulatory incentives and non-regulatory drivers that motivate private property owners to pursue solar PV systems in this municipal area. Further focus is placed on the additional regulatory incentives offered to private property owners by the said municipal authority.

Participant observation and interviews are generally used to analyse single case studies (Welman et al., 2005a). However, single case studies must have well-defined designs prior to data collection taking place. This should include key questions, along with the unit of analysis, links between data and techniques for data interpretation (Yin, 2014).

3.4.2 Strengths and Weakness of Case Study Research

Case study research presents various strengths and weaknesses that are important considerations when evaluating its suitability as a research design for a specific research question. Given the in-depth analysis of individuals, groups or a phenomenon, case-study research allows for detailed data collection through interviews, observations, and document analysis (Yin, 2014). This kind of research also allows the researcher to produce new insights by uncovering patterns,

relationships or theories related to the research topic and question(s). The single case study approach that is used in this research report also enables a holistic and comprehensive understanding of multiple aspects of the case (Yin, 2014).

The single case study approach used in this study is based on the regulatory incentives that are available to private property owners pursuing solar PV systems on a national level and within the CoCT and will therefore be conducted in a real-world setting, with its findings being applicable to practical situations. This single case study is unique and provides sufficient data for meaningful analysis. In addition to the regulatory incentives, the study further focuses on the non-regulatory drivers that are motivating private property owners to pursue solar PV systems. The findings may also inform decision-making and improve future practices (Saunders et al., 2019).

Case-study research, however, may often lead to a biased study given the researcher's subjective interpretations, personal beliefs and prior experiences that influence the study's findings and overall research process (Saunders et al., 2019). This type of study may also be a time-consuming and resource-intensive process in which the researcher could potentially draw broad conclusions based on a single case (Flyvbjerg, 2006). It is therefore important that the findings of the study be interpreted and contextualised appropriately.

3.4.3 Unit of Analysis

The unit of analysis refers to the subject that forms the focus of the research and relates to the level at which data is collected and analysed (Taylor and Sondergaard, 2017). The focus of this study is on the regulatory incentives and non-regulatory drivers that motivate private property owners to pursue solar PV systems, whereas the unit of analysis is the private property owners, their representatives or solar practitioners being interviewed. Interviews are conducted with various respondents that represent both the residential (freehold and sectional title) and non-residential sectors, which include the agricultural, commercial (offices), retail and industrial sectors.

The properties represented or owned by the respondents are all located within the CoCT. The respondents are carefully selected in order for the researcher to gain insight into the energy landscape and regulatory incentives relating to solar PV energy

from different perspectives, which include that of private property owners and industry professionals. The unit of analysis of this dissertation is therefore at the same level as the research questions introduced in Chapter 1.

3.4.4 Population and Sampling

The population of a case study represents the group of interest from which a sample is drawn. The sample is therefore a subset of the population that participates in the study (Creswell, 2018). Whilst this may seem similar to the unit of analysis discussed above, the population and sample relate to the selection of cases or participants and not the level at which data is collected and analysed (Vogt et al., 2012).

The population of the case study in this project is identified according to the scope and research objectives set out in Chapter 1. In this case, the population can be divided into two categories consisting of private property owners and solar practitioners. Although the population is divided, it provides data relating to the same issues from different perspectives. The sample is a smaller group that represents the population and allows for the generalisation of the findings (Creswell, 2018). The sampling approach used consists of a combination of convenience and purposive sampling.

Purposive sampling requires participants to meet certain criteria which is determined by the researcher (Etikan et al., 2016). For this dissertation, residential and non-residential private property owners and solar practitioners were selected as participants. The private property owners either had to represent property funds (listed or unlisted) or have a portfolio of a minimum of five properties. The properties owned by the private property owners had to be within the CoCT specifically and the private property owners had to have knowledge of solar PV systems and the related regulatory incentives, regardless of whether they had solar PV systems installed at their properties. The property types owned by the participants could include residential, retail, offices, industrial and agricultural properties. During the data collection and analysis, a distinction was made between residential and non-residential properties.

Solar practitioners operating within the CoCT were also selected as participants in order to gain insight from a different perspective. To qualify for participation in this study, the solar practitioners needed to have knowledge of the regulatory incentives

offered on a national level and by the CoCT, as well as the related processes of pursuing these incentives. The solar practitioners were also selected based on their involvement and experience in the residential, office, retail, industrial or agricultural property sectors. The participants generally needed to hold senior positions within their companies for the information provided to be credible.

The convenience sampling technique uses the most accessible sample to represent the population and is less rigorous in comparison to the purposive sampling technique (Etikan et al., 2016). The location of the properties or solar PV projects must be in the CoCT area which narrowed the participants down to their geographical proximity. Participants who were willing to participate and who were available during the data collection process were ultimately selected, given that they meet the criteria discussed as part of the purposive sampling technique.

A total of eleven private property owners and nine solar practitioners were contacted to participate in the study. From the twenty potential participants who were contacted, only eight were available and willing to participate in the study. The participants included a total of five private property owners and two solar practitioners. One of the participants were originally asked to participate as a private property owner but informed the researcher of their profession and subsequent involvement with agricultural properties. This participant therefore provided feedback from both a private property owner and solar practitioner's perspective. Table 1 provides more details about the respondents and is included in section 3.4.7.

3.4.5 Data Collection Techniques

The data collected consists of both primary and secondary data. Primary data refers to new data that is collected from original sources by the researcher directly (Farquhar, 2012). In terms of case-study research, primary data generally includes interviews (interview notes and transcripts) and participant observation (audio or video recordings). Secondary data, on the other hand, is publicly available and include articles and books, multimedia sources, databases, and annual reports (Taylor and Sondergaard, 2017). The primary data sources used in this study are discussed below.

Interviews

Interviews are one of the most common sources of data used in case-study research. Interviews can be structured, semi-structured or unstructured and the selection of an interview type mainly depends on the purpose of the research and the nature of the data collection techniques (Saunders et al., 2019). The research instrument used in this study is an interview schedule consisting of predetermined questions. The interview schedule provides a guide for the interviews.

In a structured interview, the same set of questions are asked to each research participant, thereby not allowing space to move outside the set of questions (Wilson, 2016). Structured interviews are therefore considered limiting in qualitative research, and are rather used in conducting surveys as part of a quantitative research approach.

Unstructured interviews are useful as part of an explorative investigation as it aids in clarifying concepts and problems. It is generally more time-consuming than other types of interviews as it is more of a conversation between the researcher and the research participant (Wilson, 2016). The conversation is generally based on the research topic and what avenues the researcher wants to explore, but is rather unrestricted and every interview can go in a different direction, making data comparison complicated.

In comparison to structured and unstructured interviews, a semi-structured interview comprises a set of questions that guide the interview and help to keep it on track (Wilson, 2016). It allows more flexibility as the researcher can follow topics of interest and collect detailed data. It also allows the researcher to probe responses where it is necessary for interviewees to expand or build on their answers (Saunders et al., 2019).

For the purpose of this research study, semi-structured interviews are conducted with private property owners and industry professionals to collect more detailed data and insights.

Observations

Observations can be adapted and used in all three interview formats discussed above. In terms of qualitative research or the case study approach, the behaviour of research participants can be observed and conversations recorded (Farquhar, 2012). In-person interviews can be conducted, which allows the researcher to see the participant's facial

expressions and body language. This may be useful during the data analysis phase of the research (Wilson, 2016).

Furthermore, research participants' responses are often influenced by external factors, which may make their information less reliable. Observation, therefore, offers a way of triangulating interview material (Farquhar, 2012). The observation technique was used in this dissertation to observe the participants' reactions to the interview questions, rather than to rely on the content of their answers alone. This technique also allows the interviewer to probe the participants for additional information, depending on their body language.

3.4.6 Interview Design

As noted above, interview schedules are commonly used as a guide for interviews. The same set of interview questions are posed to all research participants in the same format and order, which allows for in-depth data to be collected. This also ensures uniformity when comparing the data across different interviews.

Close-ended questions only prompt the research participant to select an answer from a fixed set of options whereas open-ended questions allow the participant to respond spontaneously (Geer, 1988). Open-ended questions are harder to code, but allow for the measurement of the participants' salient concerns (Geer, 1988). For the purpose of this study, a combination of open- and closed-ended questions were included in the interview schedule. This combination allows the researcher to ask questions that result in a clear answer from each participant. The closed-ended questions include yes-no questions, selection and identification questions. In some instances, the participants are asked to elaborate on their answers, which provides the researcher with a greater understanding of the reasoning behind these answers. As open-ended questions are often time-consuming, only a few were included in the schedule to evaluate the participants' outlook towards a specific topic.

Two sets of interview schedules were used in this study, with one set specifically aimed at private property owners or their representatives, and the other set aimed at solar practitioners. The two sets of interview schedules are attached to this report as Annexures C and D respectively. The questions included in the interview schedules assumes that the participant is either a (residential or non-residential) private property

owner, their representative, or an industry professional, such as a solar practitioner. For some of the questions, it is necessary to inquire as to the individual's profession to determine their role and expertise within the solar energy market. The information required for the research includes the participants' knowledge of the solar PV and private embedded generation markets, along with their knowledge of regulations that govern this sector and any incentives that are available to private property owners pursuing private embedded generation through solar PV systems within the CoCT.

3.4.7 Participant Labelling

A total of eight participants were interviewed, consisting of five private property owners, two solar practitioners and one engineer, who provided feedback from both perspectives. The participants provided feedback on various property sectors, with some participants providing more insight into specific property sectors such as the office, retail, industrial and agricultural sectors. Two of the participants provided feedback on residential properties from both a rental and sales perspective.

As mentioned above, one engineer was interviewed as part of this study and represented an agricultural private property owner as well as a solar practitioner. This participant was selected as they have more than ten years of experience in the solar energy industry and provided feedback on the agricultural, residential, and non-residential property sectors included in this study. The two solar practitioners interviewed have extensive knowledge of the solar energy industry in South Africa, the regulatory and non-regulatory incentives related to solar PV systems as well as the processes relating to pursuing private embedded generation. The solar practitioners were able to provide feedback on the residential and non-residential property sectors, which complemented the feedback received by the private property owners.

The participants were labelled as part of the data analysis process to ensure anonymity and to encourage an open discussion during the interviews. As seen in Table 1, the participants were labelled according to whether they are a residential or non-residential private property owner or solar practitioner, followed by their job title and the number of residential or non-residential properties owned or solar PV projects completed.

Participant Label	Description	Job Title	Properties Owned/Projects Completed
NRP^{541}_{SM1}	Non-Residential Private Property Owner (NRP)	Sustainability Manager (SM)	541
NRP^{541}_{SM2}	Non-Residential Private Property Owner (NRP)	Sustainability Manager (SM)	541
NRP^{6}_{IL}	Non-Residential Private Property Owner (NRP)	Innovation Lead: Real Estate Products (IL)	6
RP^{50}_{PA}	Residential Private Property Owner (RP)	Property Analyst (PA)	50
RP^{70}_{MD}	Residential Private Property Owner (RP)	Managing Director: Energy	70
SP^{100+}_{SR}	Solar Practitioner (SP)	Head of Strategic Research (SR)	100+
SP^{60+}_{QM}	Solar Practitioner (SP)	Quantitative Manager (QM)	60+
E^{200+}_{PD}	Engineer (E) - Represents Private Property Owners and Solar Practitioners	Head of Project Development (PD)	200+

Table 1: Participant Labelling

Figure 6 provides an explanatory example of how the participants are labelled.

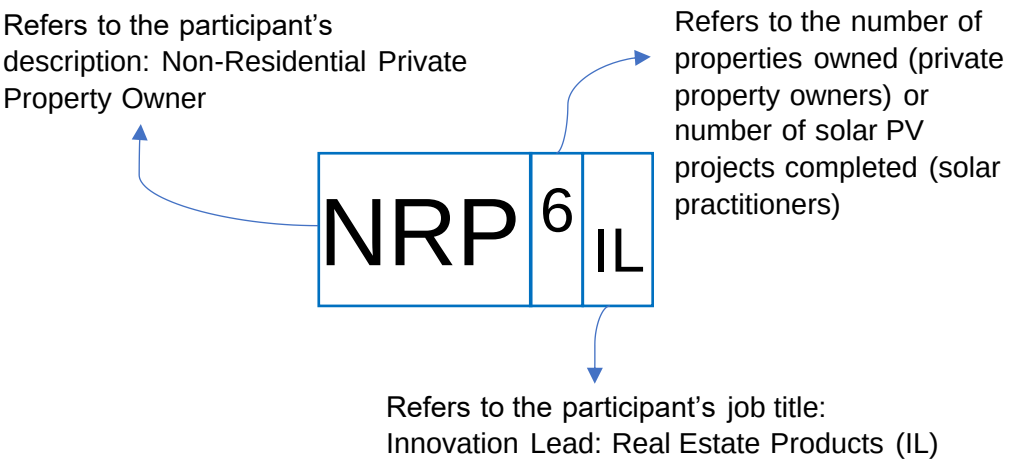

Figure 6: Example of Participant Labelling

3.5 Data Analysis

According to Schreier (2013), qualitative data analysis reduces the data collected, is flexible and systematic. There are various methods of analysing the data collected in this report, including theme identification and coding. During this process, the researcher is required to concentrate on those aspects that relate to the research question.

Themes are typically identified before data collection commences; however, they can also be identified during and after the data is collected (Welman et al., 2005b). Themes can be recognised by the repetition of keywords, through metaphors, secondary data analysis and by manipulating texts. Thematic analysis, as by the repetition of keywords, can also be referred to as groupings or analytic patterns (Welman et al., 2005b). The themes in this research report were identified by coding the interview results using the NVivo 14 software. Coding essentially categorises the data that has been collected according to themes. The data collected is reduced during the coding process, as all the information is condensed to manageable texts, which are subsequently used to construct the findings section of this report (Welman et al., 2005b).

The themes or keywords identified in this research report can be broken down into organising and basic themes, which are typically illustrated by a tree node structure (Kiger and Varpio, 2020). The organising themes of this dissertation include the outlook of the country's energy landscape, demand for solar energy / private embedded generation, regulatory incentives and non-regulatory drivers associated with solar PV systems as well as the constraints relating to private embedded generation.

The basic themes that were identified in the research represent the organising themes (Kiger and Varpio, 2020). The basic themes representing the regulatory incentives for solar PV systems include the Section 12B incentive for non-residential property owners, the rooftop solar tax rebate for residential property owners, and feed-in tariffs. The non-regulatory drivers related to private embedded generation are represented by environmental considerations, cost savings, energy security, tenant requirements, and green energy finance.

3.6 Ethical Considerations

Ethical issues need to be considered throughout the research process. Research participants should voluntarily take part in the research process by freely giving consent, given that their details will remain confidential. The participants should in no way be encouraged to take part arising from payment or any other benefit promised to them by the researcher (Wiles, 2012).

The researcher obtained ethics clearance from the University of Cape Town's Faculty of Engineering and Built Environment Ethics in Research Committee (EBE EiRC) before empirical data was collected for the study. The approved ethics clearance form is included as Annexure A.

After giving free and informed consent, research participants voluntarily took part in the research process. The consent form is attached to this research report as Annexure B. Participants were free to withdraw at any stage without any consequences. The participants were given the choice between in-person and virtual interviews depending on their availability. All interviews were conducted virtually by using Microsoft Teams and were recorded. The duration of the interviews were generally between 30 and 40 minutes.

As explained above, pseudonyms or labels are used in this report to maintain participant anonymity and confidentiality. The data gathered is stored in a password-protected file on a password-protected storage device. Only the researcher and the study supervisor have access to the original recordings of the interviews.

3.7 Reliability and Validity of the Data

The reliability and validity of the data typically refer to the measures taken to enhance the trustworthiness of the study. In terms of qualitative research, the reliability of the data depends on the consistency and stability of the findings whereas the validity of the data refers to how trustworthy, meaningful and credible the data is (Creswell, 2018).

Furthermore, the validity of the data can be tested by how accurately the participants' perspectives are represented. To ensure the reliability and validity of the data, the researcher relied on the triangulation of multiple data sources, and interviewed various

participants that own residential or non-residential properties and are pursuing solar PV energy within the CoCT or are industry professionals such as solar practitioners. The participants were expected to produce trustworthy feedback during the interviews from which their perspectives were compared and contrasted to enhance the reliability and credibility of the study (Creswell, 2018).

3.8 Scope and Limitations

Limitations typically refer to the constraints, weaknesses or challenges that have an impact on the collection, analysis and interpretation of data as part of case-study research. It is important to highlight these limitations to provide transparency in the research (Patton, 2014).

The scope of this study is limited to private embedded generation and does not include research on wheeling, power purchase agreements, independent power producers and the like. Furthermore, this study is subject to time constraints, which impacts on the depth and breadth of the data collection and analysis process, as the research report needs to be submitted timeously in order for the student to complete the degree.

Based on the above-mentioned, the findings of this study are context-specific and may not be universally applicable. Finally, the research is based on a single case study, which may be considered a methodological limitation. Ethical considerations have been discussed in section 3.6 and are not necessarily considered limitations.

3.9 Chapter Summary

An interpretivist philosophy is the appropriate methodology for this research study and a qualitative research approach is selected. The research design comprises single case study research, conducted by collecting and analysing data obtained through an interview process. Semi-structured interviews were conducted with various solar practitioners as well as with residential and non-residential private property owners pursuing solar PV energy within the CoCT. This chapter provides an overview of the ethical issues, reliability and validity of the data and any limitations that are relevant to this study.

The following chapter analyses and interprets the results from the primary and secondary data collected as part of this study.

CHAPTER 4: DATA FINDINGS AND ANALYSIS

4.1 Introduction

This chapter presents the findings from the primary and secondary data collected. The empirical data was collected from residential and non-residential private property owners as well as solar practitioners by conducting semi-structured interviews. The discussion of the findings is structured around the themes that were identified during the initial analysis. These themes can be categorised according to the research participants' outlook on the country's energy landscape, the demand for solar energy, regulatory incentives and non-regulatory drivers relating to solar PV systems, as well as the constraints relating to the implementation of private embedded generation systems.

As discussed, this dissertation comprises a single case-study analysis of the CoCT. To provide context to this study, the CoCT Metropolitan Municipality covers a total area of 2,445km² and consists of 1,452,825 households (Department of Research Analytics, 2023). The CoCT has a population of 4,772,846 which contributes to 7.69% of the national population (62,027,503) and 64.21% of the Western Cape province's population (7,433,020) (Department of Research Analytics, 2023). The map included below provides an overview of the jurisdictional area of the CoCT Metropolitan Municipality:

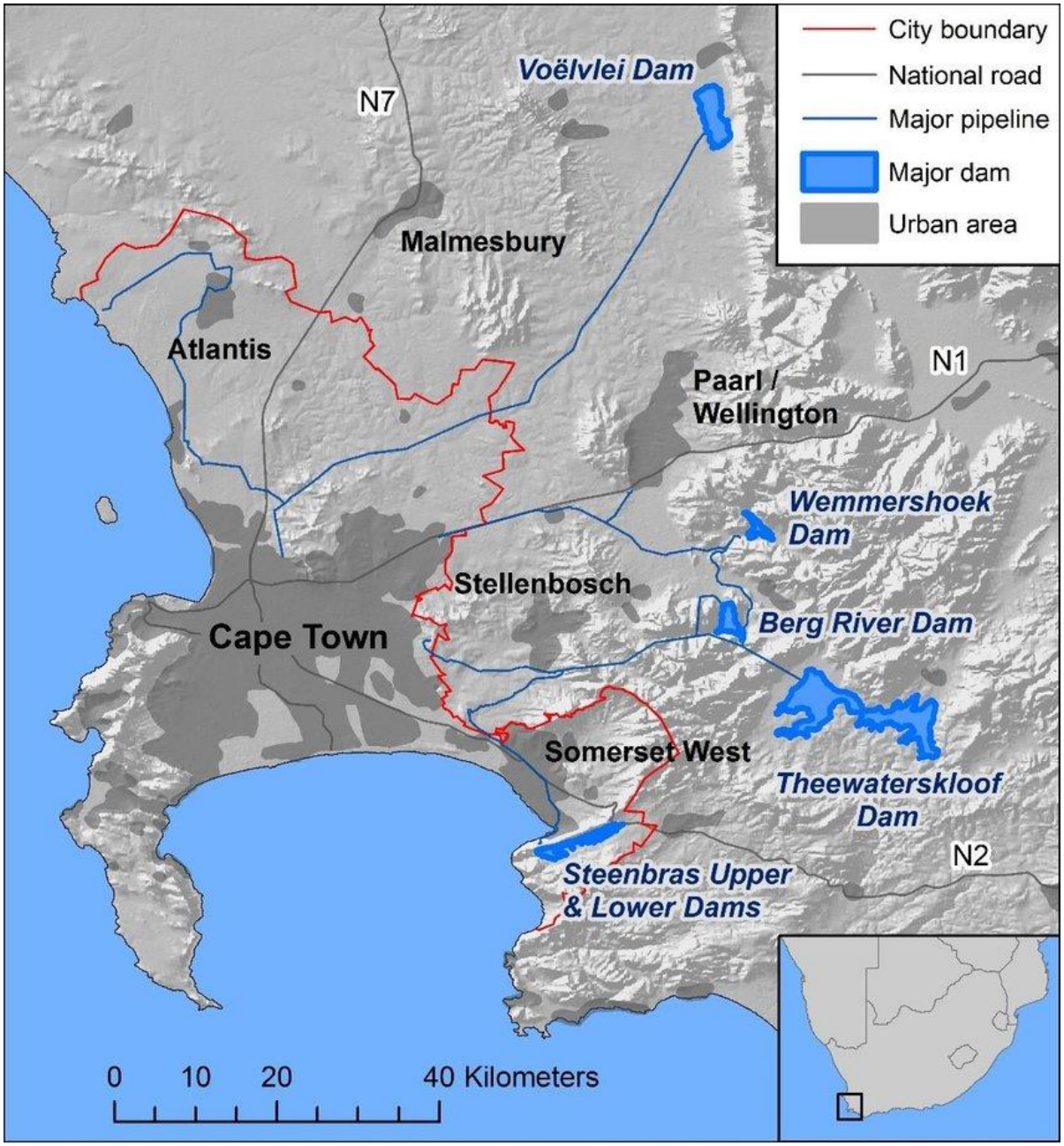

Figure 7: Map of the CoCT's Jurisdictional Area (Sinclair-Smith, 2019:3)

4.2 Outlook on South Africa's Energy Landscape

Chapter 2 of this report provided an overview of the national energy landscape, the energy crisis, the drive for renewable energy and an outline of the various role players in the country's energy sector. It was noted that the current energy crisis evidently has a negative impact on economic growth, despite the availability of renewable energy sources (Gretener and Dmitracova, 2023).

During the interviews, Participants SP^{100+}_{SR} and E^{200+}_{PD} compared the current energy crisis to a *"gold rush"* and noted that the country is experiencing an influx of foreign investment. Foreign companies are setting up businesses in South Africa's renewable energy space with the intention of capitalising on this *"rush".* Participant SP^{100+}_{SR} mentioned that the influx of renewable energy projects is impacting the already-constrained grid. This participant is of the opinion that *"the impact on the stability of the grid will be the next big focus area"*, and that the outcome of these studies will likely put a hold on the existing regulatory incentives that are aimed at promoting private embedded generation. Although the regulatory incentives discussed in this study are only temporary, the existing regulatory incentives will be in effect following the expiration of the temporary incentives and can be impacted by the stability of the grid. In addition to this, participants E^{200+}_{PD} and SP^{60+}_{QM} noted that private embedded generation may be disincentivised in future when peak electricity tariffs decrease to a more affordable level.

Participant RP^{50}_{PA} is of the opinion that Eskom is poorly run and politically motivated to continue the country's reliance on coal or fossil fuels to generate electricity. According to participants RP^{50}_{PA}, NRP^{6}_{IL} and RP^{70}_{MD}, burning coal is considered to be a cheaper option compared to investing in renewable energy and saving in the long term. Instead of investing in renewable energy, Eskom is going to invest in existing power stations in an attempt to have them running optimally. The participants are generally optimistic that the country will move towards a more sustainable energy mix, but believe that electricity could become even more expensive as Eskom needs capital to fund renewable energy projects.

The participants' optimism coincides with the literature, as various risks are associated with the use of carbon-intensive energy sources which, combined with the impact of corruption, necessitates the transition to a sustainable energy mix (Smit, 2023). Furthermore, the literature suggests that the country is moving away from fossil fuels, as the NDC's finalised targets intends to decrease greenhouse gas emissions by 2025, and more so by 2030 (Poorun and Radmore, 2022).

In terms of the future of the energy sector in South Africa, various participants are of the opinion that the generation and distribution of electricity would be privatised more and that Eskom should start competing in the renewable energy space. The

participants recommended that Eskom should retain its central role in the transmission of electricity and charge users for the use of the system. Participants NRP^{6}_{IL} and SP^{60+}_{QM} argue that the energy sector should be regulated properly and that it should consist of various energy retailers.

The participants expressed the hope that NERSA and the relevant government departments will continue to create an increasingly conducive environment for pursuing renewable energy generation. At the same time, participant SP^{100+}_{SR} fears that the increased implementation of renewable energy in the private sector may affect Eskom's bottom line, and that renewable energy will, as a result, be disincentivised by the national government, and possibly by some provincial and local governments.

4.3 Demand for Solar Energy

Given the participants' views on the country's energy landscape, and the inevitable move towards renewable and solar PV energy, the demand for solar PV energy is expected to be high. Various participants confirmed that the demand for solar PV energy and private embedded generation systems have increased substantially over the last year alone with participant SP^{100+}_{SR} stating that *"…the demand just skyrocketed. It coincides very clearly with the increase in loadshedding events".* The participants' views are in line with the literature, which suggests that increasing significance is placed on rooftop solar PV systems to restore energy security, which gave rise to the introduction of the temporary regulatory incentives (Smit, 2023).

Participants E^{200+}_{PD} and RP^{70}_{MD} commented that the demand for solar PV energy has shifted from installing solar PV panels only to installing energy systems with the integration of either a diesel generator or batteries. Although back-up battery systems and generators fall outside of the scope of this dissertation, it is important to note that solar PV systems can only function during loadshedding when coupled with either a battery system or a generator. Integrating the inverter with a battery or a generator enables the system to be a stable "baseload" power source that can respond instantaneously to step changes in the demand from the load. This allows the inverter in turn to operate the PV system at its peak operating point, which is independent from the load and dictated by solar and environmental conditions (Mohamed et al., 2022).

Solar PV systems without backup battery systems or generators are shut down during periods of loadshedding, which impacts both the solar savings that could be achieved as well as the energy security it could have provided. Participant E^{200+}_{PD} is of the opinion that the majority of solar PV systems are not connected to a backup source and that *"we're looking at about 20% to 15% loss in solar production due to loadshedding".*

According to the participants, the integration of backup systems is essential in certain industries, such as in the manufacturing and supply chain industries, data centres and healthcare facilities, as the respective properties' loads can be managed and the power generated can be used for prolonged periods of time.

Participant E^{200+}_{PD} is of the opinion that the demand for new energy systems in the agricultural sector is somewhat limited as a result of the seasonality of produce. Since uninterrupted power supply is only required during certain seasons, agricultural properties would often opt for short term-solutions such as diesel generators instead of investing in solar PV systems in the long term. Although some seasonal pack houses are pursuing solar PV systems, the current demand for new systems in the agricultural sector predominantly stems from dairy farms and those properties that require uninterrupted power supply year-round. Participant E^{200+}_{PD} commented that these agricultural properties consider long-term investments in solar PV systems to be more cost effective than using diesel generators, especially given the increase in fuel prices coupled with the increased occurrence of power cuts.

Furthermore, a large percentage of agricultural property owners are currently considering second phase installations and expansions. This could mainly be ascribed to favourable green-energy financing conditions and the financial implication of the combination of high fuel prices and frequent power cuts. Significant increases in fuel prices and the frequency of loadshedding over the past two years are illustrated in Figures 2 and 3 in Chapter 2, which verifies the participants' views.

The office sector is considered to have the lowest demand for solar PV energy when compared to the retail, industrial and agricultural property sectors. This is especially true for high-rise office buildings as various participants commented that roof space is often limited. NRP^{541}_{SM1} commented that *"because of the nature of office building*

being high rises, the solar energy generated is basically between 20% and 35% of the actual need, which is insufficient". Participants who own retail properties or operate in the retail sector indicated the opposite as these properties often have very large roof areas, which is ideal for solar PV installations. In addition to the large roof areas, retail properties' peak use is typically during the daytime, which overlaps well with peak solar generation times.

In terms of the residential property sector, participants RP^{50}_{PA} and RP^{70}_{MD} commented that they will only consider installing solar PV panels with backup battery systems at sectional title schemes or apartment blocks to supply electricity to common areas for security purposes. Owners of freestanding houses would, however, consider installing solar PV systems with backup batteries to provide electricity to appliances, lights and plugs within the house.

Generally, the greatest demand for electricity in the residential sector is during the evening and early morning when residents are at home. In terms of sectional title schemes and freestanding houses, participants RP^{50}_{PA} and RP^{70}_{MD} note that the integration of batteries with a solar PV system is the best way to harness the energy generated during the day. However, these integrated systems are expensive to install and effectively lower the demand for solar PV systems in the residential property sector due to cost constraints (Schulte et al., 2022).

4.4 Regulatory Incentives for Solar PV Systems

The participants commented that supportive energy policies and regulations also drive the implementation of private embedded generation systems given the regulatory incentives that are available on both national and municipal levels. These regulatory incentives are not considered to be one of the main drivers but nonetheless influence private property owners' decision-making process when pursuing solar PV systems. The participants argued that the energy policies and regulations are currently oriented more towards renewable energy and embedded generation systems than it was in the past. This makes investing in and financing solar PV systems, amongst others, more attractive given the improved and conducive regulatory environment.

Participant RP^{50}_{PA} commented that current energy policies and regulations are promoting embedded generation as it provides a number of benefits for both

residential and non-residential property owners. In terms of non-residential private property owners, these benefits or incentives include an income tax rebate, NERSA-approved FiTs and an additional FiT provided by the CoCT, as indicated in Chapter 2. Residential private property owners can benefit from a rooftop solar rebate (which can be viewed as a 'cash back' incentive), a NERSA-approved FiT and the additional FiT provided by the CoCT.

Certain incentives such as the rooftop solar rebate and Section 12B tax allowance are offered at a national level, with other incentives such as FiTs being offered on a local government level by the CoCT. The influence that each of these incentives have on promoting the implementation of solar PV systems by private property owners are further discussed below.

4.4.1 Section 12B Incentive for Non-Residential Property Owners

The demand for solar PV installations increased substantially over the past year, with an even greater increase at the beginning of 2023. This does not only coincide with the increase in loadshedding events, but also with the end of the 2022/2023 tax year and annual budget speech. Numerous businesses were motivated to install solar PV systems as soon as possible following the announcement of the temporary increase in the Section 12B tax allowance in order to benefit from this incentive during the current tax year. As a solar practitioner, participant E^{200+}_{PD} confirms that they had a "*mad rush in the beginning of the year*" due to clients requesting the close out of solar PV system installations and to be invoiced before the end of the tax year.

Various participants noted that the Section 12B capital allowance is "*very welcome*" as it provides non-residential property owners or businesses with the opportunity to reduce their taxable income on the cost of the investment by 125% in the first year (Taxation Laws Amendment Bill B36 of 2023). This allowance results in a saving on the cost of the solar PV system. Participant RP^{50}_{PA} is of the opinion that the temporary increase in the Section 12B capital allowance is promoting the move towards solar PV generation systems, as the allowance *"increases your savings or investment return"*. Various participants agree with this and Participant E^{200+}_{PD} added that the tax incentive "*is not the reason someone's pursuing solar, but it's definitely the reason they're pursuing solar today instead of in a few years' time*".

From a financial perspective, the participants representing non-residential property owners are of the opinion that the Section 12B tax allowance is a lot more viable than FiTs and that they would rather pursue the Section 12B incentive.

4.4.2 Rooftop Solar Tax Rebate for Residential Property Owners

As discussed in Chapter 2, the Rooftop Solar Tax Rebate is temporarily available to residential property owners and tenants. This incentive enables households and individuals to claim a rooftop solar tax rebate of 25% of the cost of the rooftop solar panels or up to R15,000 in total from 1 March 2023 to 29 February 2024 (Minister of Finance, 2023). It is important to note that the rebate is limited to the installation of solar panels only, and does not include backup battery systems.

Participants NRP^{541}_{SM1}, NRP^{6}_{IL}, SP^{60+}_{QM} and RP^{70}_{MD} commented that households' demand for electricity are typically early mornings and late afternoons / evenings (i.e. before and after work). The installation of a complete energy system consisting of solar PV panels and backup batteries are noted as being unaffordable for many households. In general, backup battery systems tend to be more expensive than solar panels when installed separately.

However, households and individuals tend to install backup battery systems instead of solar panels only, as this provides them with backup power throughout the day and at night. The power generated from solar PV panels can only be used during the day. Furthermore, it cannot be utilised during loadshedding if not integrated with a storage solution. Therefore, although the installation of solar panels is incentivised by the rooftop solar tax rebate, the incentive is considered to be too small to pursue. A number of participants also argued that those households or individuals who can afford to install solar PV systems with backup batteries that match their demand are generally not motivated by the incentive, and rather pursue solar energy for other reasons such as energy security or saving on their utility bill.

Based on the above, it is clear that the rooftop solar tax rebate is not considered a main driver of the demand for solar PV energy in the residential sector. Participants NRP^{541}_{SM1}, RP^{50}_{PA}, SP^{60+}_{QM} and RP^{70}_{MD} are of the opinion that the rebate, simply put, "*is not worth it*" as the tax rebate is "*too small*".

4.4.3 Feed-in Tariffs

The FiT incentive essentially allows residential and non-residential private property owners to sell the surplus power they generate back to the grid whereafter their electricity bill is credited. As discussed in Chapter 2, the CoCT offers a NERSA-approved FiT (78.98c/kWh and 73.87c/kWh) and an additional FiT of 25c/kWh to its customers to feed electricity back into the grid (CoCT, 2023b). The CoCT started implementing the additional FiT for commercial customers from June 2023 and plans on implementing it for residential customers from the end of 2023 (CoCT, 2023a).

In terms of residential property owners, the participants commented that private embedded generation systems are expensive to install and that households generally aim to install a solar PV system that is only big enough to match their demand. Participant RP^{50}_{PA} shared that they only plan on feeding electricity back into the grid once their demand is met. The majority of participants, however, do not plan on feeding electricity back into the grid at this stage. Participant RP^{70}_{MD} argued that they have *"a well-established load profile"* and that the installation of additional solar PV panels is not feasible *"at this stage"*. According to Participant RP^{70}_{MD}, the current FiT is insufficient in providing a real saving, and that FiTs will only really be feasible once it has doubled. According to Schulte et al. (2022), residential private property owners would either match their demand with a solar PV system or install a backup battery system instead.

In addition to the above, Participant RP^{50}_{PA} mentioned that it is difficult to budget for the current FiTs, as the tariffs typically change on an annual basis. Households are therefore unable to rely on the potential savings created by feeding back into the grid. Rather than including FiTs in their financial viability considerations, they regard any saving associated with the FiTs as a bonus.

Non-residential property owners represented by Participants NRP^{541}_{SM1}, NRP^{541}_{SM2}, NRP^{6}_{IL} and E^{200+}_{PD} also confirmed that they do not include the credits received from FiTs as part of their cashflow projections or feasibility studies. The participants noted that the projected credits can only be considered once the government commits to a FiT for a fixed period of approximately 10 to 20 years. Participant NRP^{6}_{IL}, however, commented that some of their planned embedded generation systems will feed as

much as 20% of the generated capacity back to the grid and that the credits received will result in a saving on their utility bill.

Although there are contradictory opinions about the benefit of the FiT incentive, this does not mean that FiTs do not play a role in the decision-making process of installing solar PV systems. Instead, participant SP^{100+}_{SR} is of the opinion that the opportunity to feed back into the grid *"definitely gives private property owners peace of mind"*. For instance, should operations (such as production lines) at a non-residential property be suspended temporarily and without warning, the solar power generated would be fed back into the grid during such a time. This prevents the wasting of generated energy when it cannot be used by the property and allows the property owner's account to be credited, which provides a saving on their operating costs.

During the interviews, solar practitioners and CoCT-supplied customers/property owners mentioned that the CoCT is ahead of most municipalities in terms of renewable energy generation. The additional 25c/kWh FiT that is being implemented by the CoCT makes a noteworthy difference when added to the NERSA-approved FiT of 78.98c/kWh for residential customers and 73.87c/kWh for commercial customers respectively.

The participants mentioned that Eskom-supplied customers are generally not as committed or interested in pursuing solar PV systems when compared to CoCT-supplied customers. This could be ascribed to the lack of incentives and lengthy process for Eskom-supplied customers to register a private embedded generation system (Eskom, 2023a). Participant SP^{100+}_{SR} added that FiTs are not offered on a national level, and are not being implemented by numerous other municipalities across the country. According to participant SP^{100+}_{SR} *"the big hurdle at the moment is getting feed-in tariffs implemented across the country"*.

Furthermore, the CoCT has clear guidelines for property owners on how to register private embedded generation systems and how to benefit from the regulatory incentives that are currently available, which complements the implementation of the additional FiT. Eskom-supplied customers need to go through a more "*strenuous*" procedure, as commented by participants NRP^{541}_{SM1} and NRP^{541}_{SM2}, which may deter property owners from pursuing grid-tied solar PV systems. As discussed in Chapter 2, this process involves the payment of quotation fees to Eskom, conducting a capacity

study, and submitting various documents to Eskom which includes an EGI compliance test report, a wiring CoC, an inverter certificate and a NERSA registration certificate (Eskom, 2023a). Eskom-supplied customers may be deterred to pursue private embedded generation systems as the process of registering these systems also takes months to complete.

According to Participant SP^{100+}_{SR}, the CoCT makes "*moving forward a lot quicker and more comfortable than elsewhere in the country*" given the incentives offered, as well as their streamlined processes and good service delivery.

4.5 Non-Regulatory Drivers Related to Private Embedded Generation

In terms of the implementation of private embedded generation systems, the participants identified environmental considerations (especially in the non-residential property sectors), cost savings, energy security, tenant requirements and favourable financing solutions as the main drivers having the greatest influence on private property owners during decision making processes. These drivers are discussed in more detail below.

4.5.1 Environmental Considerations

Various participants in both the residential and non-residential property sectors commented that they have become more aware of their carbon footprint. Private embedded generation systems therefore provide a good starting point to lower their carbon emissions. Participants NRP^{541}_{SM1} and NRP^{541}_{SM2} represent a listed fund that own a large and diversified property portfolio and are required by their investors to reduce their negative environmental impact. Listed funds' investors typically require them to publish public reports regarding the status of their ESG requirements (Liang et al., 2021).

Participant RP^{70}_{MD} stated that they have self-imposed targets to acquire green building certificates from the Green Building Council of South Africa on their developments. As mentioned previously, these certificates essentially rate each development's performance from an environmental sustainability perspective and is considered to improve marketability and sustainable building (Simpeh and Smallwood, 2023). Installing solar PV systems therefore aids in acquiring a green building certificate.

The participants are motivated by the abovementioned aspects to implement renewable energy or embedded generation systems at their properties. The environmental sustainability aspect of implementing a solar PV system for embedded generation purposes is considered a major driver for the property owners interviewed who owns office buildings.

4.5.2 Cost Savings

Participants NRP^{541}_{SM1}, NRP^{541}_{SM2} and E^{200+}_{PD}, who represent private property owners with grid-tied solar PV systems, have noted that they are only able save on electricity costs during the day when there is no loadshedding. This is mainly due to their systems not being connected to backup batteries or generators, which would otherwise provide power to the inverters to continue running during power cuts. Without backup batteries or generators, solar energy is wasted during loadshedding as the energy generated cannot be used or stored. Given the extent of large industrial and retail properties, for example, solar PV installations are often not integrated with battery systems due to cost constraints and the size or output of the installation.

Various participants have emphasised that their diesel costs have increased significantly over the past year and that it is directly related to the increase in power cuts. This relationship was introduced in Chapter 2 and illustrated in Figures 2 and 3, and has now been reiterated by the participants. Participants RP^{50}_{PA} and NRP^{6}_{IL} plan on installing grid-tied solar PV systems coupled either with backup battery systems or their existing diesel generators. This will allow them to save on diesel costs during periods of loadshedding, as generators run at a lower capacity compared to when they are not coupled with solar PV systems. Sufficient backup battery systems remove the need for diesel generators which provides a saving on fuel costs in the long term. Furthermore, should a solar PV system generate enough electricity to be stored, the stored electricity could be used at any time of the day, which results in a further saving on electricity (Poorun and Radmore, 2023).

In addition to the above, participant RP^{50}_{PA} notes that *“installation costs are becoming more affordable and energy generated through solar PV systems are more cost effective in the long term”*.

The move towards renewable energy appears to be naturally driven by the cost of electricity. According to participant E^{200+}_{PD}, this move could potentially drive the demand for backup battery systems and result in tariff arbitrage. The participant explained that tariff arbitrage occurs *"when battery systems are charged during off-peak hours, when electricity tariffs are low, and the stored electricity is used during peak hours, when electricity tariffs are high"*. By doing this, consumers benefit from low electricity tariffs and manipulate their monthly electricity consumption, which affects the municipality's income. Participant NRP^{6}_{IL} explained that the CoCT relies on the income generated from the sale of electricity to maintain the electricity grid in the metro and to provide good quality service delivery. The increase in private embedded generation may, as a result, lead to the increase in electricity tariffs.

Participants NRP^{541}_{SM1} and NRP^{541}_{SM2} have solar PV systems installed at various properties and indicated that these systems provide a saving on the property's operating costs and reduces the tenant's cost of occupancy. This saving is generally attributed to the relatively low cost of solar PV systems compared to the high cost of electricity over the medium- to long term. Since electricity is typically recovered from tenants, they are also able to save on electricity costs as a result of high electricity tariffs. In addition to this, the participants argued that the saving in operating costs offsets the cost of diesel when a generator is used to keep grid-tied systems running during loadshedding.

According to participant SP^{100+}_{SR}: *"an embedded generation solar system is a savings measure…driving energy savings".* In this case, the participant refers to *"energy savings"* as the saving in electricity costs given the increasingly high electricity tariffs. This statement supports the information relayed above. Participant SP^{60+}_{QM} agrees with this statement and adds that a diesel generator or battery system that is integrated into an embedded generation system not only allows for cost savings, but ensures energy security for both the tenant and property owner. Energy security as a driver for implementing private embedded generation systems is further discussed below.

4.5.3 Energy Security

Participants SP^{60+}_{QM} and RP^{70}_{MD} commented that residential property owners and owners of smaller industrial and retail properties typically install solar PV systems for

energy security purposes by reducing their reliance on Eskom. The same applies to the agricultural sector, which requires uninterrupted power supply during certain seasons or for certain operations. Non-residential property owners with larger retail or industrial properties are less motivated by energy security and are instead motivated by the cost savings discussed in Section 4.5.2 above.

According to participant SP^{100+}_{SR}, there are two ways for property owners to increase their security of supply with a solar PV system. The first is "*to integrate it with batteries or a backup system, and the other is to integrate with existing diesel generators on site*". This allows the grid-tied system to function during periods of loadshedding and provides private property owners with greater energy security, allowing them to be self-sufficient (Schulte et al., 2022). The participants generally agreed that the CoCT is encouraging private embedded generation, and that the municipality is working with their customers to reduce the municipality's reliance on Eskom.

4.5.4 Tenant Requirements

According to NRP^{6}_{IL}, "*tenants are really driving the speed of the rollout*" in terms of solar PV systems in the commercial, retail and industrial property sectors. Various non-residential participants noted that tenant requirements are one of the main drivers for implementing embedded generation (typically coupled with a diesel generator). Participants NRP^{541}_{SM1} and NRP^{541}_{SM2} commented that some of their tenants include large call centres and international companies who require continuity in their operations.

According to the participants, some tenants are taking strain given the poor economic conditions and cannot necessarily afford the increase in utility or diesel costs, which affects the affordability of rental rates and the property owner's income. Participants NRP^{541}_{SM1} and NRP^{541}_{SM2} note that some tenants complain about their low productivity levels during power cuts and typically request that backup power solutions be installed. As mentioned previously, the installation of solar PV systems mitigates the rising cost of electricity for tenants and minimises the loss in productivity as a result of loadshedding (Creamer, 2022, Nedbank, 2023).

In addition, various tenants operate within the manufacturing sector that requires uninterrupted energy supply for cooling chambers and heavy-duty

machinery/equipment. Participant NRP^{6}_{IL} emphasised that there is no real impact on the property owner, as the tenants bear the brunt of loadshedding either by running diesel generators or paying the owner for solar power.

In terms of the residential sector, tenanted complexes are requesting landlords to provide power to the common areas during nighttime. Participant RP^{50}_{PA} owns multiple tenanted residential complexes and commented that they have received numerous requests to provide power to the common areas during loadshedding for the tenants' safety and security. Participant RP^{50}_{PA} is planning to install solar PV systems at some of their properties, which they will couple with backup battery systems to supply uninterrupted power to security cameras, electric fences, guardhouses and security gates.

Participant RP^{70}_{MD}, a residential property developer, similarly noted that safety and security is a major driver of demand for solar PV installations in the residential property sector, along with the convenience of having power during loadshedding periods. Participant RP^{70}_{MD} is therefore including solar PV systems as part of their product as *"there is greater demand for housing units within complexes that offer alternative energy solutions"*.

4.5.5 Green Energy Finance

In terms of green-energy financing solutions, the major banks have created loan products specifically tailored to solar energy (Poorun and Radmore, 2023). Participant E^{200+}_{PD}'s experience is that *"banks are eager to finance solar PV systems as these loans less risky"*. Participant SP^{100+}_{SR} adds that the application process for solar/green bonds has become a lot easier since the banks have streamlined the process. The accessibility of solar financing is noted by various participants to play an important role in their decision-making process. The participants were also in agreement that favourable financing conditions, short payback periods and high returns on their investments are motivating them to finance their solar installations. According to Poorun and Radmore (2023) and Nedbank (2023) these loans cover between 70% and 100% of the capital costs of a solar PV installation and offers a five- to ten-year loan repayment period.

Participants NRP$^{6}_{IL}$ and E$^{200+}_{PD}$ further commented that, in terms of non-residential properties, roof replacements are often factored into the financial feasibility of a solar PV system. Participant NRP$^{6}_{IL}$ owns various industrial properties with asbestos roofs and noted that they factor the cost of replacing these roofs into the total cost of the energy system they plan to install. The total loan amount would therefore include the total amount of the required energy system plus the new roof. Participant NRP$^{6}_{IL}$ further added that, given the high electricity prices and favourable weather conditions, they projected that they will likely repay these loans over a shorter time period than expected. In terms of the typical payback period, participants NRP$^{6}_{IL}$ and RP$^{70}_{MD}$ noted that they are able to repay their loans within three to five years, whereas the lifespan of a solar PV panel is approximately 25 years.

4.5.6 Ranking of Incentives and Drivers

In summary, the drivers discussed above can be ranked according to their relevance and importance for each property sector included as part of this study. Since the participants identified five drivers in addition to the regulatory incentives discussed in Section 4.4, each driver is ranked from one (1) to six (6) in Table 2, with one being the most relevant or important driver and six being the least relevant or important driver for each property sector. The numbers are colour-coded, with green representing the drivers that are most relevant and red representing those that are less relevant.

Driver	Property Sector				
	Residential	Offices	Retail	Industrial	Agricultural
Environmental Considerations	4	1	4	6	4
Cost Savings	2	3	1	2	1
Energy Security	1	5	2	3	2
Tenant Requirements	5	2	3	1	6
Energy Finance	3	4	5	4	3
Regulatory Incentives	6	6	6	5	5

Table 2: Ranking of Drivers for Implementing Private Embedded Generation Systems

As seen in Table 2, each driver's relevance and importance are viewed differently by each property sector. The table is based on the opinions of the participants that were interviewed as part of this study. In terms of the residential sector, households are typically motivated by energy security, followed by cost savings and energy financing solutions and less motivated by environmental considerations, regulatory incentives and tenant requirements.

The non-residential property sectors included in this study consist of offices, retail, industrial and agricultural properties. The office sector is mainly driven by environmental considerations and tenant requirements. The interviewed participants associated with office properties predominantly included representatives of a listed fund. It is clear that these drivers are most relevant, as listed funds typically need to report on their ESG requirements. Regulatory incentives are considered least relevant as office buildings typically have small roof areas which allows for much smaller solar PV installations.

In comparison, retail properties often have large roof areas that can be filled with solar panels. Given the scale and potential output of these installations, cost savings and energy security are considered the most relevant and important drivers in the retail sector. The retail sector is also driven by tenant requirements and environmental considerations, and is less driven by energy finance solutions and regulatory incentives. The regulatory incentives are considered an added bonus, rather than a main motivating factor.

The industrial sector's outcome differs slightly from the other non-residential property sectors in that tenant requirements are considered the most relevant and important driver, followed by cost savings and energy security. Various industrial tenants operate in the manufacturing sector and require uninterrupted power supply, but also require a more cost-effective way of operating during loadshedding periods than letting their generators run at full capacity, especially given rising diesel prices. The remaining drivers are generally considered advantageous, but have less of an influence during decision-making processes.

In terms of the agricultural sector, cost savings and energy security are considered the most relevant and important drivers, followed by energy finance and environmental considerations. Given the labour- and capital-intensive nature of agricultural properties, cost savings are expected to be the highest ranked driver. Energy security is also expected to be a main driver in the agricultural sector, as these properties are reliant on uninterrupted power supply for certain elements such as cold storage, packhouses and pumphouses, for example. Tenant requirements is ranked the lowest of the drivers, as agricultural properties are typically owner operated. Regulatory

incentives have some influence on the decision-making process to install solar PV systems, as it provides an added benefit in the form of tax incentives and FiT's.

4.6 Constraints Relating to Private Embedded Generation Systems

Various constraints relating to private embedded generation systems were evident during the interviews. The constraints broadly include the timing of peak energy generation using solar PV systems, the cost of importing solar panels, rooftop requirements and the low level of education regarding solar PV systems amongst private property owners. Further constraints include the availability of FiTs and the generation threshold, although the latter was recently removed. These constraints are discussed in more detail below.

One of the constraints that emerged from the interviews are that solar panels can only generate power during the day when the sun is shining. This has an impact on the pattern by which energy is consumed, and does not benefit those that operate during the nighttime. This is especially true for households, data centres and the manufacturing and supply chain sectors, as offices, retail and agricultural properties are able to use solar energy during the day.

Another constraint highlighted by participants NRP^{541}_{SM1} and NRP^{541}_{SM2} is that solar panels are often imported, and the cost of solar PV system components are sensitive to changes in currency exchange rates. When the Rand becomes weaker, solar panels become more expensive to import and affects the financial feasibility of installing these systems. As mentioned by participant E^{200+}_{PD}, the cost of solar PV systems is already unaffordable for most households. According to participant SP^{100+}_{SR}, this is also the case for green bonds, as increases in the cost of living directly affects households' disposable income and they are therefore unable to afford the monthly bond instalments.

In addition to the above, participant SP^{100+}_{SR} states that many private property owners "*want to install an embedded generation system, but their roofs don't allow for it*". Participant SP^{100+}_{SR} mentions that the reasons for this include the incorrect orientation of the roof (a northern orientation is required), limited roof space (which is often the case with high rise office buildings), asbestos roof sheeting or an inadequate roof structure that is unable to carry the load of the solar panels.

Participant NRP^{6}_{IL} commented that there is an abundance of contractors selling and installing solar PV systems. Given the low level of education around these systems, the majority of private property owners are hesitant to commit. They are often entirely reliant on advice from contractors regarding the kind of system and the specifications required. Furthermore, other than comparing quotations from different contractors, there is hardly a way for them to ensure that they are paying the right price for the installed system. Solar PV systems also need to comply with Eskom or the CoCT's requirements (Eskom, 2023a, CoCT, 2023a).

According to participants E^{200+}_{PD} and RP^{70}_{MD}, the administrative process to register private embedded generation systems and connect these to the grid is inefficient, expensive, and time-consuming, and that the move towards a more sustainable energy mix will be slow as a result. These factors are considered to deter Eskom- and CoCT-supplied customers in pursuing private embedded generation systems, as they often have to wait months to get permission to install solar PV systems. The inefficient and slow approval processes for the installation of solar PV systems also appear to be driving the demand for backup battery systems instead, especially in the residential sector, as these systems do not require any approvals.

Furthermore, participant SP^{60+}_{QM} commented that private property owners *"are often under the impression that they can reduce their reliability on Eskom by installing solar panels"*. Participant RP^{70}_{MD} added to this by stating that solar panels alone will not make them self-sufficient or improve their energy security. To achieve these objectives, households and businesses would need to couple their solar PV installations with a backup battery system or generator.

The participants added that too much reliance is placed on contractors or installers who are not necessarily compliant. Participant SP^{60+}_{QM} states that the regulation of contractors is essential going forward, as contractors typically *"do not take responsibility for their installations"*. Participant NRP^{6}_{IL} agrees and adds that contracts relating to the installation of solar PV systems are often complex and that private property owners do not necessarily understand where the risk is passed.

Various participants highlighted that FiT's are limited as they are only offered on a municipal level by some municipalities such as the CoCT and is not available on a national level. Furthermore, the participants commented that the threshold for private

embedded generation (without a licence) was too low in the recent past. The literature review established that the embedded generation threshold was increased substantially in October 2021, and that the threshold was removed completely in December 2022 (Electricity Regulation Act 4 of 2006 Licensing and Exemption Registration Notice). According to SP^{100+}_{SR}, the threshold was previously regarded as a big constraint as the generation licences for embedded generation systems were *"nearly unattainable"*.

The constraints discussed above can be ranked according to their relevance for each property sector included as part of this study. The participants identified six constraints and each constraint is ranked from one (1) to six (6) in Table 3, with one being the most relevant and six being the least relevant constraint for each property sector. The numbers are colour-coded, with green representing the constraints that are most relevant and red representing those that are less relevant.

Constraint	Property Sector				
	Residential	Offices	Retail	Industrial	Agricultural
Timing of Energy Generation	1	5	6	1	2
Imported Solar Panels	2	2	1	4	1
Rooftop Requirements	4	1	4	3	6
Level of Education	3	3	3	5	4
Availability of FiT's	5	4	5	6	5
Generation Capacity	6	6	2	2	3

Table 3: Ranking of Constraints Relating to Private Embedded Generation

As seen from the table included above, the relevance of each constraint differs for the respective property sectors. The timing of peak energy generation (during the daytime) is considered to be the greatest constraint in the residential and industrial property sectors. This is mainly due to residents being at home during the early mornings, late afternoons and at night. Therefore, they are unable to benefit optimally from the sunlight, unless their solar PV systems are coupled with backup batteries which stores the solar energy generated during the day. Various industrial properties operate 24 hours per day and the energy generated during the daytime can only be used whilst generated, whether or not this coincides with the property's peak operation times.

The retail and agricultural sectors are mostly impacted by the cost of solar PV systems being sensitive to changes in currency exchange rates. Apart from the industrial sector, the retail and agricultural sectors often require large-scale solar PV

installations. Changes in currency exchange rates therefore have a direct impact on the feasibility of installing solar PV systems at retail and agricultural properties.

Rooftop requirements are the biggest constraint for the office sector, as office buildings typically have small footprints and therefore limited roof space for solar panel installations. This is also considered one of the main constraints in the industrial sector, as numerous industrial properties in the CoCT still have asbestos roofs. Solar panels cannot be installed on asbestos roof covering, and these roofs typically have inadequate structures to support the additional load from solar panels.

The low level of education surrounding the implementation of private embedded generation systems are ranked as relevant in the residential, office and retail sectors. Residential customers do not necessarily have enough knowledge in this field and are hesitant to commit due to the high volume of contractors selling solar PV systems. The office and retail sectors are reliant on contractors to install compliant solar PV systems and are oftentimes reliant on the contractor's advice due the lack of experience and knowledge of private embedded generation systems.

The availability of FiTs is not considered a major constraint by any of the respective property sectors. Since the regulatory incentives are considered an added bonus by some of the participants, the absence of national FiTs is considered a constraint as Eskom-supplied customers cannot currently benefit from this incentive.

Although the threshold for private embedded generation (without a licence) is generally not considered to be a constraint anymore, this used to be considered a major constraint by the retail, industrial and agricultural sectors prior to the threshold being removed in December 2022. This is mainly due to these sectors generating more than the historical 1MW generation threshold which required a *"nearly unattainable"* generation licence.

4.7 Chapter Summary

Upon analysing the data that emerged during the interview process, it is noted that the current energy crisis is seen as a *"gold rush"* given the influx of foreign investment in the renewable energy sector. Private embedded generation systems are naturally driven by the cost of electricity and the need for uninterrupted power supply. In

addition, the demand for solar PV systems increased substantially over the past year, which clearly coincides with the increase in loadshedding events.

In terms of non-residential properties, the office sector has the lowest demand for solar PV systems. This is primarily due to the limited roof space of high-rise office buildings and solar installations not being able to generate adequate power for the whole building. In comparison, the retail and industrial sectors have the greatest demand for solar PV systems. These sectors' demand is complemented by large roof areas which allows for good generation capacity. Given the extent of large industrial and retail properties, for example, solar PV installations are oftentimes not integrated with battery systems due to cost constraints and the size or output of the installation.

For residential properties, the demand for backup batteries trumps the demand for solar PV systems. This is a direct result of loadshedding as residential property owners would rather opt for backup power which they can use at any time of the day. In terms of both residential and non-residential private property owners, the implementation of solar PV systems is generally driven by the regulatory incentives and non-regulatory drivers.

The relevance and importance of each of these incentives and drivers are viewed differently by each property sector and are typically influenced by the attributes of the various property types. Environmental considerations are considered most relevant in the office sector and least relevant in the industrial sector. Cost savings are most important in the retail and agriculture sectors, followed by the industrial and residential sectors. Energy security is considered the most relevant driver by the residential sector, whilst tenant requirements is the main driver for the industrial sector. Energy finance and regulatory incentives are not considered as important as the other drivers and were typically ranked as having less relevance across the various property sectors.

The participants noted that one of the issues relating to solar PV systems is that private property owners are often uneducated as they are under the impression that they can become self-sufficient by installing solar PV systems. In addition to this, it was commented that the process to register these systems and to connect to the grid is often inefficient and expensive. Notwithstanding, the participants noted that NERSA and the relevant government departments are creating a conducive environment for

pursuing renewable energy generation through the implementation of tax incentives, rebates and FiTs.

Similar to the drivers, the issues or constraints relating to solar PV systems were also ranked according to their relevance for each property sector. The timing of solar energy generation, which is only possible for a short period of time when the sun is shining, is considered a major constraint by the residential and industrial sectors as the daytime energy does not necessarily align with their peak consumption times. The cost of imported solar panels is the biggest constraint for the retail and agricultural sectors and is arguably due to the scale of solar PV installations at these properties.

Furthermore, rooftop requirements are considered the greatest constraint by the office sector. This is especially true for high rise office buildings, as the roof area for solar PV installations is limited. The remainder of the constraints identified by the participants are considered less relevant, and includes the level of education around solar PV systems, availability of FiTs and previous generation capacity threshold.

In terms of the regulatory incentives, the participants have contradicting views on the FiTs offered by the CoCT. The FiTs are generally welcomed but are considered too low to provide real savings. FiTs may change annually, which makes non-residential property owners sceptical to include this incentive in their cashflow projections. By default, residential and non-residential property owners typically install solar PV systems to match their demand, which allows very little or no room to sell electricity back to the gird.

The Section 12B tax allowance is notably the most prevalent incentive amongst non-residential property owners and offers the greatest benefit of all of the current regulatory incentives. The temporary increase in the Section 12B tax allowance has fast-tracked numerous private embedded generation system installations and motivated more non-residential property owners to pursue solar PV systems now, rather than in two years' time when the incentive is reduced. In comparison, the rooftop solar tax rebate is considered too small for residential property owners, with none of the participants interviewed currently pursuing or planning on pursuing this incentive.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This research study investigates the regulatory incentives and non-regulatory drivers for private property owners to pursue solar PV systems. This final chapter reflects on the fulfilment of the research questions and objectives, as well as the research proposition set out in Chapter 1. The chapter further comments on the literature and the findings obtained during the empirical data collection process. Finally, conclusions are drawn and further research recommendations are suggested.

5.2 Addressing the Research Questions and Objectives

The research questions and objectives set out in Chapter 1 of this study are closely related. The research questions asked at the outset of this study was:

a) Which regulatory incentives exist for residential and non-residential private property owners to pursue solar PV systems?

b) What are the non-regulatory drivers that motivate private property owners to pursue solar PV systems?

c) To what extent are the regulatory incentives considered a determining factor for private property owners to pursue solar PV systems, when compared to non-regulatory drivers?

The research questions have been answered and their respective objectives have been fulfilled as follows:

5.2.1 Regulatory Incentives to Pursue Solar PV Systems

This research question investigates which regulatory incentives are available to private property owners on both a national and municipal level to pursue solar PV systems, focusing on the CoCT specifically. The research question further investigates the difference between the regulatory incentives offered for residential and non-residential private property owners respectively. The research question and its associated objective were mainly achieved through the literature presented in Chapter 2 and were reiterated by the participants as part of Chapter 4.

Table 4 provides a summary of the regulatory incentives that are available to residential and non-residential private property owners pursuing solar PV systems. The table further illustrates the regulatory incentives based on the incentives that are available on a national level and those incentives that are offered by the CoCT at municipal level.

Regulatory Incentives Offered on a National Level	
Incentives for Residential Properties	**Incentives for Non-Residential Properties**
Rooftop Solar Rebate: Temporary Expansion to the Income Tax Act 58 of 1962 (Includes a tax rebate of 25% of the cost of rooftop solar panels and is limited to R15,000 per individual or household).	Capital Allowance: Section 12B of the Income Tax Act 58 of 1962 (states no threshold on generation capacity, and businesses may claim 125% of the cost of the investment in the first year).
Regulatory Incentives Offered by the City of Cape Town	
Incentives for Residential Properties	**Incentives for Non-Residential Properties**
NERSA-approved feed-in tariff of 78.98c/kWh.	NERSA-approved feed-in tariff of 73.87c/kWh.
Additional feed-in tariff of 25c/kWh to residential customers from the end of 2023.	Additional feed-in tariff of 25c/kWh for commercial customers from June 2023.

Table 4: Regulatory Incentives Promoting Solar PV Energy for Private Property Owners

From Table 4, it is evident that the greatest difference between the regulatory incentives offered at the national level and by the CoCT is the type of incentive. The regulatory incentives offered on a national level typically include capital subsidies and tax incentives, whilst those offered at municipal level by the CoCT only include FiTs.

Only one incentive is available for both residential and non-residential properties on a national level. The Rooftop Solar Rebate, which is a temporary expansion to the Income Tax Act 58 of 1962, is available to residential private property owners. This incentive essentially offers households and individuals a rebate on the installation of rooftop solar PV panels. Individuals and households may claim a tax rebate of 25% of the cost of the rooftop solar panels in the 2023/2024 tax year only and the rebate is limited to a maximum of R15,000 per individual or household (Minister of Finance, 2023).

A capital allowance in terms of Section 12B of the Income Tax Act 58 of 1962 is available to non-residential private property owners on a national level. This incentive was temporarily expanded for a period of two years, from 01 March 2023 until 28 February 2025. As part of this expansion, the 100MW threshold on generation capacity has been removed to stimulate investment in renewable energy sources. Businesses generating solar PV energy, regardless of the extent to which energy is generated, are able to reduce their taxable income on the cost of the investment by 125% in the first year, given that the asset is brought into use by the taxpayer/property owner for the first time (Werner and Ackermann, 2021).

It is evident that the regulatory incentives available to non-residential property owners on a national level are more favourable than the maximum rebate that is available to individuals or households in the residential sector. Furthermore, the residential rebate is only valid for one year whilst the temporary expansion of the Section 12B capital allowance is valid for two years.

Within the CoCT, NERSA-approved FiTs are available to both residential and non-residential properties and requires a grid-tied solar PV system. The two FiTs are similar, although the FiT for residential properties are marginally higher than the FiT for non-residential properties. The CoCT is also planning on implementing an additional FiT which would be applicable to both residential and non-residential private property owners. Both property types should be able to benefit from the additional FiT by the end of 2023. Although the additional FiTs would be implemented in the non-residential property sector first, this is only considered an advantage for property owners in this sector for a short period of time.

5.2.2 Non-Regulatory Drivers to Pursue Solar PV Systems

The second research question focuses on which non-regulatory drivers are motivating private property owners to pursue solar PV systems. In order to answer this research question, the following objective had to be fulfilled:

> Identify additional drivers that motivate private property owners to pursue solar PV systems.

The research question and objective stated above were mainly achieved by assessing the current state of the energy crisis and the resultant impact on private property

owners. The impact of the energy crisis has led to additional (non-regulatory) motivating factors for private property owners to pursue solar PV systems which were identified as part of this study.

As discussed in the literature, the country's energy crisis has worsened progressively over the past sixteen years. This has led to subsequent increases in the cost of electricity and diesel and has a profound impact on the country's economy (Weimar, 2023), impacting both residential and non-residential private property owners.

The country's reliance on coal for energy generation frequently results in a shortfall of power and necessitates the move towards a more sustainable energy mix. Renewable energy generation is therefore expected to play an important role in South Africa's future energy systems. Private embedded generation in the form of rooftop solar PV systems is considered a viable option to combat the impact of the energy crisis for both residential and non-residential private property owners. This could be ascribed to the benefits and relative affordability of installing solar PV systems.

In terms of the impact of the energy crisis on non-residential property owners, operating costs are directly affected by the combination of high diesel prices and the need to run diesel generators for extended periods of time during loadshedding. As a result, the participants explained that businesses' profitability and rental affordability are impacted by the energy crisis and that tenants are now requesting their landlords to install solar PV systems. This is complemented by the improved accessibility of green-energy financing by the major banks, which plays an important role in a private property owner's decision-making process.

The installation of solar PV systems allows businesses to use less fuel to keep generators (and inverters) running during loadshedding (during the day) which results in a cost saving. In the medium to long term, the combination of paying for reduced amounts of fuel together with the cost of the solar PV installation is still more cost effective than running generators at full capacity during loadshedding periods. Furthermore, the environment, along with businesses' productivity and output are also negatively impacted by the energy crisis, as most businesses need to pause their operations during power cuts when there are no alternative energy solutions available. Businesses have also become more aware of their carbon footprint and realize that

the implementation of solar PV systems will reduce their carbon footprint and minimize carbon tax levies.

In comparison to businesses, households are mostly inconvenienced by loadshedding and prefer backup battery systems in addition to, or instead of, solar PV systems as this provides them with uninterrupted power supply during the evenings and early mornings when they are at home.

The non-regulatory drivers were introduced in Chapter 2, but were clearly identified by the participants in Chapter 4. According to the participants, environmental considerations, cost savings, energy security, tenant requirements and favourable financing solutions are the main drivers that have the greatest influence on private property owners during decision making processes.

5.2.3 Determining Factors to Pursue Solar PV Systems

This research question investigates the extent to which the regulatory incentives are considered a determining factor for private property owners to pursue solar PV systems, when compared to the non-regulatory drivers.

In order to answer this research question, the following objective had to be fulfilled:

> Establish to what extent the regulatory incentives influence private property owners to pursue solar PV systems, when compared to non-regulatory drivers.

In order to answer the research question and fulfil the objective included above, the non-regulatory drivers were compared to the regulatory incentives to determine the extent to which each factor motivates private property owners to pursue solar PV systems.

From the research undertaken, it is evident that both residential and non-residential private property owners are mostly motivated by the non-regulatory drivers that solar PV systems offer, especially compared to the regulatory incentives that are currently available to them. The regulatory incentives are generally too small compared to the cost of installing a solar PV system and therefore play an insignificant role in private property owners' decision to pursue solar PV energy.

In terms of the regulatory incentives that are available to residential private property owners, the temporary rooftop solar rebate is too small to compensate for the large

capital outlay of installing a solar PV system. The same applies to the FiTs offered by the CoCT given that these FiTs need to double before it results in a real saving for households.

The Section 12B capital allowance promotes the uptake of solar PV systems amongst non-residential private property owners. The participants have experienced a notable uptick in the number of installations of solar PV systems at the beginning of 2023, around the time when the incentive was expanded and before the end of the 2022/2023 tax year. The expansion of the Section 12B tax incentive is motivating private property owners to pursue solar PV systems before the end of February 2025, when the temporary expansion expires.

In comparison, contradicting views exist amongst non-residential private property owners regarding the FiTs offered by the CoCT. On the one side, the FiT potentially provides them with a saving on their utility bill and allows them to receive a credit for electricity sold back to the grid, instead of wasting unused electricity when they are not operational (say over weekends or holiday periods). On the other side, the FiT is too low and solar PV/private embedded generation systems are generally designed to meet the respective property's demand. The FiT is also variable and cannot be budgeted for in the medium to long term as it can change on an annual basis with no prior indication as to whether it will increase or decrease. The Section 12B income tax allowance therefore offers a greater benefit compared to the municipal FiT incentive and is seen as a bonus to the non-regulatory drivers and benefits that are available.

The non-regulatory drivers were noted to have a greater impact on private property owners in both the residential and non-residential property sectors compared to the regulatory incentives discussed above. The importance of these benefits in each property sector were summarised in Chapter 4 using Table 5 which included again for ease of reference.

Driver	Property Sector				
	Residential	Offices	Retail	Industrial	Agricultural
Environmental Considerations	4	1	4	6	4
Cost Savings	2	3	1	2	1
Energy Security	1	5	2	3	2
Tenant Requirements	5	2	3	1	6
Energy Finance	3	4	5	4	3
Regulatory Incentives	6	6	6	5	5

Table 5: Ranking of Drivers for Implementing Private Embedded Generation Systems

Non-residential private property owners are mostly motivated by cost savings, energy security, retaining their tenants by meeting their tenants' requirements, green energy financing and environmental considerations. The non-regulatory benefits differ slightly for residential private property owners as these benefits are mostly related to cost savings due to increasingly high electricity costs, enhanced energy security when the solar PV system is coupled with backup batteries, and the accessibility of energy financing.

From Table 5, it is evident that the regulatory incentives are generally considered to have the lowest impact on private property owners to pursue solar PV systems as these policies and regulations are ranked the lowest amongst all the property sectors included in this study.

5.3 Revisiting the Research Proposition

As stated in Chapter 1, the research proposition for this study is:

Despite the regulatory incentives introduced by government, private property owners are rather motivated by a variety of non-regulatory drivers to pursue solar PV systems.

This research proposition is fully supported. The data established that private property owners are mostly motivated by non-regulatory drivers to pursue solar PV systems compared to the regulatory incentives available on both a national and municipal level. The non-regulatory drivers stem from the negative impact that the energy crisis has on the economy and the benefits associated with moving towards a more sustainable energy mix. The regulatory incentives are generally considered an added benefit, but are not the reason why private property owners are pursuing solar PV systems.

5.4 Concluding Remarks and Further Research

The economic and environmental impact of the ongoing energy crisis and the move towards a more sustainable energy mix are motivating private property owners to pursue solar PV systems. Private property owners are, more specifically, motivated by drivers such as environmental considerations, cost savings, energy security, tenant requirements, and energy finance. This study shows that the regulatory incentives are too low, especially in the case of FiTs and the residential Rooftop Solar Rebate incentive. The Section 12B Capital Allowance for non-residential properties is the only regulatory incentive that is noted to influence the decision-making process of private property owners pursuing solar PV systems.

Given the qualitative nature of this study, the participants represent residential and non-residential private property owners and solar practitioners and allow for the generalisation of the findings. The researcher is of the opinion that the outcome of the study would be similar if a greater population were interviewed.

Based on the above outcomes and conclusions, the following recommendations are made for further research:

a) Similar studies can be conducted in other municipal areas for comparison of regulatory incentives at a local government level. However, it is anticipated that the conclusion would be the same. The financial reward (in the form of tax incentives and FiTs) is not the most significant driving factor for private property owners to install solar PV systems. Therefore, the research can be expanded to determine whether the implementation of a national FiT would promote the implementation of private embedded generation systems.

b) The research can be expanded to study the impact of private embedded generation systems on the stability of the electricity grid and whether the current regulatory incentives that are aimed at promoting private embedded generation should be put on hold as a result.

c) Another recommendation would be to determine how the incentives and drivers motivating South African private property owners compare to the incentives and drivers in other parts of the world.

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ANNEXURE A: ETHICS CLEARANCE

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

2023/06/26

EBE/00243/2023

RE: Research Ethics Committee Project Approval Letter

Dear Michelle Scholtz,

Your application for ethics review of your project titled

Regulatory Incentives for Private Property Owners to Pursue Solar Energy.

has been reviewed and evaluated by the

Engineering & Built Environment Committee.

You may proceed with your research project titled:

Regulatory Incentives for Private Property Owners to Pursue Solar Energy.

Please note that should:

(i) any serious or adverse effects to participants occur and/or,

(ii) aspect(s) of your current project change and/or

(iii) any unforeseen events that might affect continued ethical acceptability of the project occur then you should immediately report this to the approving REC. You may be required to submit an amendment to this application, in order to determine whether the changed aspects increase the ethical risks of your project.

Based on the information supplied your application has been successful and is approved.

Please note the following additional conditions associated with this approval:

(i)

Regards,

Engineering & Built Environment Committee.

ANNEXURE B: CONSENT FORM

Research Project Information Sheet and Consent Form

Regulatory Incentives for Private Property Owners to Pursue Solar Energy

Good day, my name is Michelle and I am conducting research towards a Master's degree at the University of Cape Town. I am researching the regulatory incentives that are available to private property owners pursuing solar energy generation. I would like to invite you to participate in the research project.

The research project aims to determine which regulatory incentives currently exist for private property owners to pursue solar energy, how these incentives differ for residential and non-residential property owners, which additional incentives are offered by the City of Cape Town and what influence these incentives have on the move towards solar PV energy generation. The focus is on small-scale embedded generation, and the study therefore excludes regulatory incentives relating to wheeling, independent power producers and power purchase agreements.

I want to interview private property owners, their representatives and / or professionals who work in the renewable energy sector and have had first-hand experience with the issues mentioned above. This consent form clarifies that your participation in this research is voluntary and the choice to participate is yours alone. There will be no repercussions if you choose not to participate or choose to withdraw at a later stage. I would, however, be grateful if you would assist me by allowing me to interview you.

The interview will consist of a thirty-minute face-to-face or virtual interview, depending on your availability and preference. It will take place where it is most convenient for you. You will not, however, receive any form of remuneration. The interview will be recorded to ensure accuracy of the research and reporting of the results. You will not be subject to any risk or harm due to the interview.

Anonymity and confidentiality will be maintained using pseudonyms throughout the research project (e.g. Head of Sustainability A). Furthermore, confidentiality will be maintained through the storage of all research data in a password protected file on a password protected storage device or disk. This will only be accessible to me and the research supervisor at UCT. You will not have any direct benefits from this research

project. However, you will have access to the final research report should you require it for future reference.

Name of Participant: .....

Signature of Participant: .....

Date: .....

ANNEXURE C: INTERVIEW SCHEDULE – PRIVATE PROPERTY OWNER

Participant's Name:

Please tick the appropriate box below:

Residential Property Owner ☐ Non-Residential Property Owner ☐

If you are a non-residential property owner, please indicate what kind of property or properties you own. This may include commercial, retail, industrial, medical, or agricultural properties.

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1. Is the property (or properties) located within the City of Cape Town Metropolitan Municipality?
2. What impact does the energy crisis have on your property or business?
3. Are you aware of the national regulatory incentives (relating to solar energy) that are available, as well as the additional incentives offered by the CoCT? See a summary of the available incentives below:

Regulatory Incentives - National	
Residential	**Non-Residential**
Feed-in Tariffs	Feed-in Tariffs
Rooftop Solar Rebate	Section 12B Capital Allowance
Regulatory Incentives – City of Cape Town	
Feed-in Tariff of 25c/kWh to residential customers by the end of 2023	Feed-in tariff of 25c/kWh for commercial customers

4. Do you have any solar PV systems installed at said property / properties or planning on doing so in the near future?
5. If so, what was the major motivating factor(s) to do so? (Was this related to saving

on utility bills, meeting ESG requirements, minimising your reliance on Eskom, any other reasons not mentioned here.) If not, what are your concerns / restraints?

6. Will you feed electricity back into the grid to benefit from the Feed-in Tariffs that are available, claim a rooftop solar rebate (for residential properties) or a tax deduction in terms of Section 12B (non-residential properties)?

7. If so, what was the major motivating factor(s) to do so? If not, what are your concerns / restraints?

8. Have you, in the past, benefitted from any of the regulatory incentives that are available? If so, please elaborate. If not, please provide a reason as to why you haven't.

9. Do you think the regulatory incentives that are offered on a national level and by the CoCT could be improved? If so, what suggestions do you have?

10. Do you know of any other municipalities that offer similar regulatory incentives to the CoCT?

11. In your opinion, what drives the demand for solar PV systems? (Do the incentives play a significant role, or does the demand stem from loadshedding related reasons or any other reasons not mentioned here?)

12. What is your view of South Africa's energy landscape over the next 10 to 20 years? Do you think the country will move towards a more sustainable energy mix (as per the Just Energy Transition Plan), that more reliance will be placed on the private sector or that Eskom will no longer have a monopoly, but instead become one of many electricity retailers whilst maintaining a central role in the transmission of electricity?

13. Do you have any further comments?

ANNEXURE D: INTERVIEW SCHEDULE – SOLAR PRACTITIONER

Participant's Name:

Profession:

Company Name:

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1. Do you work within the renewable energy sector and more specifically, with solar PV installations?
2. Are your projects located within the City of Cape Town Metropolitan Municipality?
3. In terms of private property owners, have you seen an increase in demand for solar PV installations over the past few years?
4. Do you experience increased demand in a specific property sector? (This could be in the residential, commercial, retail, medical, or agricultural property sectors)
5. In your experience, what are the drivers of demand for solar PV installations? (Why are private property owners pursuing solar energy generation? Is this related to loadshedding, saving on utility bills, meeting ESG requirements, minimising reliance on Eskom or any other reasons not mentioned here?)
6. In your opinion, do the regulatory incentives available to private property owners bear any weight in the decision-making process of going solar? If so, which regulatory incentives are most often claimed by these property owners?
7. In addition to this, what are some of the biggest constraints experienced by private property owners who want to pursue solar energy generation?
8. Could the regulatory incentives that are offered on a national level and by the CoCT be improved? If so, what suggestions do you have?

9. Do you know of any other municipalities that offer similar regulatory incentives to the CoCT?

10. What is your view of South Africa's energy landscape over the next 10 to 20 years? Do you think the country will move towards a more sustainable energy mix (as per the Just Energy Transition Plan), that more reliance will be placed on the private sector or that Eskom will no longer have a monopoly, but instead become one of many electricity retailers whilst maintaining a central role in the transmission of electricity?

11. Do you have any further comments?

ANNEXURE E: SAMPLE TRANSCRIPT

Interview with a Private Property Owner

Date: Tuesday, 12 July 2023

Time: 10:00

MS: Michelle Scholtz (Interviewer)

NRP^{6}_{IL}: Non-Residential Private Property Owner 3

The interview starts with MS greeting participant NRP^{6}_{IL} and thanking them for their time and attendance.

MS: In terms of the properties you own, they're all located in Salt River and Epping, right?

NRP^{6}_{IL}: Correct, yes.

MS: Do you know what the impact of the energy crisis is on these properties or on the business?

NRP^{6}_{IL}: You see, so it's kind of a funny thing in the way that this thing is structured because the tenants take most of the brunt of loadshedding. It's actually an odd thing, like I feel it's more on tenant business and tenant areas, that's where the pressure is coming from, because you are now needing to help your tenants out to keep their businesses up and running. It's really more about business support than it is, like if the electricity doesn't work, then in theory, the lease, because of how the lease agreement is structured, there's no real impact on the landowner, except when the tenant isn't able to pay rent anymore. That's when it really becomes a problem.

So we've had several tenants in a few properties who we can see and who have told us that they're taking strain as a result of it, especially the guys who are high energy users and ones who, actually the office park is the easy one, it's mostly the industrial properties that we are focused on at the moment, because they are the ones who struggle when it goes down, because you have to, I don't know, some of them have like heating elements and cooling chambers and things like that, which means that you can't go up and down because the systems aren't able to take that level of disruption. There are a lot of heating elements that take a while, 45 minutes or whatever it is to

actually fully heat up. It's stuff like that where you need to provide a level of non-interruption, I think, in order for them to do better, never mind diesel costs and all of those things. So I think it's really more of allowing the tenants to have uninterrupted business, that's the major push, that's the thing, and the ones where, you know, it's really the tenants that are pushing this to a large extent for us, it's like, it's useful, it's got a decent return on it, but it's actually the tenants that are really driving the speed of the rollout, in my view.

MS: Okay, and you are aware of the incentives?

NRP^{6}_{IL}: I wasn't.

MS: So, I mean, the regulations do come from the national government and industry bodies, and then the City of Cape Town implements these regulations. So even with the feed-in tariffs, I think the City of Cape Town managed to negotiate a higher feed-in tariff with NERSA compared to, say, Buffalo City.

NRP^{6}_{IL}: Oh, I see, okay. So, yeah, I mean, I'm aware of them, I know about the feed-in tariffs, I know about the Section 12b allowance, and obviously we're using that in our calculations.

MS: Well, yeah. And are you using the 125% or what are you basing it off of?

NRP^{6}_{IL}: Yeah, it's at 125%, I think. Why is there another one?

MS: It used to be… Below one megawatt, it used to be a 100% deduction, and then above one megawatt, it was that 50%/30%/20% deduction over three years.

NRP^{6}_{IL}: I've got some old proposals here still…All the latest stuff that we're doing is at the 125%, everything that I've seen recently. So we're budgeting at 125% in the hopes, because what it ends up being, a total incentive, depending on your tax rate, about 27.5%. Because it's an allowance, right, so it's just a tax incentive, so all it means is that I can reduce taxes.

MS: Yeah.

NRP^{6}_{IL}: So it doesn't end up actually being 125%, it ends up being the corporate tax of that, which is, I don't know, it's a corporate tax listed VAT or something, I don't know, but yes, we are using the full amount in order to make the ROEs look better.

MS: Okay, so you don’t have any solar installed at the moment, but you are going to?

NRP$^{6}_{IL}$: There is one installation in Epping, and there is going to be in Salt River but it's a small one.

MS: Yeah, on the offices.

NRP$^{6}_{IL}$: Correct, it's on the office roof, but there's going to be two more now that we're going to be doing, both in Epping. That's all the industrial ones, and we are going to be installing it in the office park soon too, but it's again, it's not the most urgent, because they, like if they need to run on an hour of diesel, it doesn't have like the biggest impact, so we're not super, super stressed about it, and the tenants aren't worried about it as much, but it is on the list, but the industrial is way ahead of the pack, like it's on the priority list, if I can put it that way.

MS: Okay, and what were some of the major motivating factors to do it? Was it only because of the tenants complaining or pushing for it, or was it, I mean you don't really have ESG requirements as such.

NRP$^{6}_{IL}$: I mean we do, the self-proclaimed ones that they put into the annual reports and stuff like that, like most companies, so there is a, there's definitely like a want to get off of it, there is, I would say that sort of minimizing reliance, i.e. minimizing risk, is always an issue, because no one really knows how long load shedding is going to be around for, so that's certainly an issue. I would, the saving on the utility bills, because we're mostly a, because in the way that I look at it, it's mostly as a landowner, not as a tenant, as an occupier, the saving on utility bills doesn't matter as much.

MS: Yeah, because it just gets pushed down to the tenant.

NRP$^{6}_{IL}$: Exactly, so yeah, I think it's just more like minimizing reliance on ESG, instead of reducing risk, that's all that they're really worried about.

MS: And do you have any concerns about it or not really?

NRP$^{6}_{IL}$: What? Concerns about what?

MS: About going solar.

NRP$^{6}_{IL}$: Yeah, it's a bit of a wild west at the moment, it feels like, everybody and their aunty is doing solar, you don't know if you can trust the installations, I don't know how the value chain is structured properly, it feels like a lot of people are, I don't know, taking kickbacks, it feels very unregulated at the moment, and when I say unregulated, I mean

like the installation part of it, all of that, and maybe it's because I'm more new to it, we're only going to really do our first big installation in the next couple of months. I've done a lot of like theoretical looking at it, but it feels like, I don't know, it feels like the insurance industry in a way…

There's brokers, you don't know what kickbacks they're getting, you don't know why they're recommending certain things, and you as a non-technical expert, sorry, as a non-technical person, I'm not an expert in this thing, so you do, I feel like I can fall victim to something very expensive very quickly, so that's what's been making me very nervous about implementation, to the extent that we've actually just hired somebody now who's like an advisor, who is, he specializes, his company specializes in sort of, we call it environmental and sort of social, no sorry, environmental installations around water, some water saving stuff, solar, whatever, and it's a company that's been operating for like the last 10 years or something, so.

MS: Okay, it's not Energy Partners?

NRP[6]IL: No, it's a company called PJC, it's a few people, they're like just a partnership, and they don't do, they don't do the installation, they only do advisory consulting, so they consult to like Growthpoint, to say these are the different ways that you can meter differently to save water, this is how you can install this, and so they do a lot of work with like the Green Building Council and stuff like that, so, but the view was, it was only because I don't trust anybody that is currently trying to sell it to us, and they're selling it for like… These are 5, 10 million rand installations, it's not for jokes, but I don't, it's not easy to see how the contracts work, it's not easy to see where the risk gets passed in different parts of the transaction, so a lot of that stuff is making me very nervous, so that's the stuff that I am really worried about.

I'm worried that this thing is going to, in five years' time, is not going to function any longer, I'm a little bit worried about technological speed, that by the time you install it, it's already old, so stuff like that, but look, if the financials play out the way that they say the financials play out, then it's fine, then I'm not too worried about it. If it can last five years, it's okay, I'm sure it's going to last longer, but yeah, I don't know, so I'm very, I'm quite sceptical about it, but we'll see what happens.

MS: Rather safe than sorry, but yeah. I think if you've got a good team, then you'll be fine.

NRP$^{6}_{IL}$: No, the financial part of it is easy to understand, it's sort of the physical elements that I'm a little bit worried about, and it's the trustworthiness of the counterparts that's the issue for me.

MS: Okay, and are you going to feed back into the grid, or, I mean, are you only considering the tax incentive?

NRP$^{6}_{IL}$: No, part of the financials is the feed-in, although it's, I mean, you don't go for it, it's only there because we're just creating a little bit of excess capacity for future, like for future growth, that's the only reason that it exists, so yeah, we definitely, I think it is, in the systems, there's around 20% that's going to be feed-in at the moment, but we're obviously not building it for feed-in, that would be silly.

MS: Okay, no, yeah, 100%, and I mean, this is basically a cash flow exercise.

NRP$^{6}_{IL}$: Yeah, it really is, and we're getting, there's quite favourable conditions that the banks are willing to put on it, or certainly our bank, so that's what's also motivating us to do it, so if I can get, if I can get it financed over a 10-year period, for example, and the payback period is three and a half years, then it makes complete sense for me, so it's part of the motivating stuff, so it's really, so if I can, because it means that I can also act with that interest, so suddenly the ROEs skyrocket, and that's the whole point, not the whole point, but it's like, I don't know if we would do this if there wasn't tenant demand, but there's tenant demand, so I may as well.

MS: Yeah, yeah, and you're obviously going to have to replace a large part of the roof at one of the properties in Epping?

NRP$^{6}_{IL}$: Yes, one of them have asbestos. We have to replace the roof, we have to just build it into the costs now. So we don't just look at the solar, we look at solar plus roof, and then go, okay, what's the cost of this going to be?

MS: Okay, yeah, and if it's viable or not.

NRP$^{6}_{IL}$: Exactly. It would be nice if they offered, if we could put that as part of the incentive, that would be awesome, but that's not going to happen. I mean, it gets rid of asbestos, so I figured that that would be nice. So we're adding some value, going to end up paying capital gains on this thing, and there's no incentive in place for it, but still lovely. Yeah. So just, it just disrupts the payback period, obviously, because it's quite expensive. Yeah. It's going to be like R1.7 to R1.8 million.

MS: And the tenant, will they be able to operate during this time when the roof's being replaced?

NRP$^{6}_{IL}$: Yeah, they just have to be smart about exactly how the replacement works. I think they'll just sort of sweep it and time it as they do. It looks like it's also only going to be a half of the roof, the north-facing half, so it all depends on how the costs play out. They apparently can segregate it quite easily on the different pitches. So we'll see, but we're getting a couple of roofing consultants to go and check and see if it makes sense.

MS: Okay, that's interesting. So you haven't really benefitted from any incentives in the past?

NRP$^{6}_{IL}$: I don't think we have benefited from something like this in the past, no.

MS: So are you going to put battery backup at both properties in Epping or is it kind of going to go with the generator?

NRP$^{6}_{IL}$:It's way too expensive. They're going to have to do it, they're going to back up with the generator. It's just way, way too expensive because industrial doesn't really make sense because of the KVAs that they use, or because of the, I mean, Moody is talking about like 600KVA batteries. Too expensive. No, all it would be even worse because they have much bigger heating equipment. So just on industrial, the battery is just like, it's crazy. I think for the battery they quoted us five and a half million.

MS: What?

NRP$^{6}_{IL}$: So there's no way. And so we said, look, if the tenant wants to install it, they can, but in reality, like it just, it doesn't make sense if they, I mean, if they were going to offer an incentive on that. I just don't see what the, if they do, if you do solar plus a battery, that kind of makes sense because then you're not putting pressure on the grid. Um, cause then you're actually just using your own solar, but I don't know if they would allow that.

MS: Yeah. I know. And I think, is it America, they are forcing people when they install solar, they're forcing them to install batteries now as well.

NRP$^{6}_{IL}$: Yeah. Which kind of makes sense. I mean, if you're going to give people, if you can give people incentives to drive electric vehicles, then does it also make sense then to force them to make the houses more, um, sort of to take them more of the houses off the grid. It totally makes sense to me, but I don't, I don't know if we can afford

something like that just yet paying for paying for those batteries. Also, the technology is moving really quickly, so. Yeah. I don't know if they would want to. No, I don't think so.

MS: And in terms of the incentives, apart from giving an incentive for battery backup with solar or a roof, a roof allowance, roof replacement allowance, are there any other improvements? Um, I've heard a lot of views on, um, which is not really based on the city of Cape Town, but the implementation thereof could be better.

NRP^6_{IL}: I think the wheeling thing, they need to get the hell sorted out that the minute they can, that's not a city of Cape Town issue. It's a national issue. It sounds like, yeah, but it's also a municipal issue because they also have to price it here and then like figure out how they're going to pay back Eskom and all of that. And I don't know the unbundling of this transmission lines and all of that, but the, if they allow for wheeling, anybody who has money now will be able to create capacity.

If they don't allow wheeling, then no, the feed-in tariff, either you decide the feed-in tariff is going to be better or you allow for the wheeling or both, hopefully. But for me, it doesn't make sense. I think the feed-in tariff doesn't make sense. Um, I think it should be, it should naturally be higher if you really are trying to encourage it. And I think, look, they probably have to limit it because of budget constraints and that's fine. Um, but I would imagine that because it's sort of a feed through in the sense that the City of Cape Town is only the middleman, right? I would imagine that they can do a higher feed-in tariff, but I guess there's pressure from NERSA, there's pressure from Eskom. Eskom wants you to use, despite what they say, I feel like they do want you to use as much expensive power as you can.

MS: Of course. I've heard that, well, everyone's basically waiting for the City of Cape Town, um, they've got a wheeling pilot project that's about to take off soon. It seems like everyone's kind of just waiting to see like how the City of Cape Town does it, whether it works out and how they do it before they start implementing it on a national level.

NRP^6_{IL}: But it's silly. I don't know why people wait for other environments to do it, test it in your own because there's also these very different types of environments, like COJ has City Power, which is a very different relationship. I think City Power also has much more generation capacity than what we do. So it's a very odd bunch of, I don't know, each one is unique. I don't understand why it is that they've decided to wait, but God bless

them. Like, I don't want to be them. I want to get the wheeling done because it means that if we've got access to finance, it means you build more.

We've got five properties in Epping. I'm happy to wheel from one to the other, but just tell me how much it's going to cost on the distribution system. But I also know that the unbundling is going to take three more years. There's no way, like, I don't think the transmission unbundling is going to happen very soon and so the pricing is going to be different and there's going to be a lot of, or there'll be a lot of variability in the pricing, but I would love for the wheeling to get sorted out now because then I think we really unlock private capital and I know other properties are going to start their wheeling. They're going to do solar and then the whole wheeling thing as part of the pilot project.

MS: Oh, okay. So it's going to be like probably on one of their biggest properties and then it's going to wheel to all of their smaller…

NRP$^{6}_{IL}$: Correct. So that's why we want to do one installation at Moorsom and wheel to all the other properties. Ideally. That would have been the simplest version of this, but because we aren't allowed to do it yet, or it's not ready, you're now going to waste R5 million from Moody. Well, not waste, but you are going to, it's just much less efficient use of capital. It wouldn't necessarily have been like necessary to do it. Because I could have powered all of Moorsom and all of that with it. It's the same thing because there's so much room space.

MS: Yeah, and maybe even the smaller ones in, is it Moody Avenue?

NRP$^{6}_{IL}$: Yes. No, we probably could have powered the whole thing. Yeah. But. Yeah. I mean, there's, we'll see.

MS: Okay, so you've basically answered or touched on the next question about what drives the demand for solar. It's kind of getting a little bit off the grid, minimizing your risk, tenants pushing landlords and favourable financing conditions.

NRP$^{6}_{IL}$: I mean, it's not favourable, the interest rate cycle is not great. It could have been better. But in reality, you can do a 10-year loan for solar just off the back of your current loan agreement. Because my payback period is less than that. So it means that in year 6, 7, 8, 9, 10, it's free money. That's awesome. I'm happy to do that. Then I'm happy to refinance again in five years' time and do something similar for the balance of the solar period.

And the banks know this, I'm sure. So to be honest with you, I thought that the returns would be lower on some of this. I honestly didn't know if it's because I'm just not used to this like South African sort of return environment and like use of capital, like return on capital. But it feels like, I mean if you're financing, it's like 90% to 100% ROIs. It's amazing. So I'm super happy about that. I don't know how this 12B incentive is going to play out. This like sort of one-time shock that you get. I don't know if it's helpful. Maybe it is. If it's fully recoverable. Anyway, I don't trust it just yet. I'm waiting for the system to play itself out.

MS: Fair enough. The returns seem a little bit too good to be true right now. So I'm waiting for the other shoe to drop. Well, rather be like mentally prepared for it than be surprised. What's your view of the energy landscape? So I've been told 10, 20 years is pessimistic. I don't think so. But I mean, yeah. What do you think?

NRP^{6}_{IL}: Why are you saying 10, 20 years? Why is 10 years pessimistic? For me, I feel like we just always struggling to get ahead. And other people are like, yeah, but everyone's like pulling their weight and it's going to be fine and give it five years. I vacillate on this one. There are days when I'm like, this lot can't manage a mess up in a brewery, right? And then there's other days when I'm like, wait, no, it'll be fine. Like, if you look at the way that they're leveraging in the private sector in Cape Town at the moment, I think, OK, you know what? Now we'll be fine. We'll be OK. Municipalities are going to struggle. Eskom is going to struggle because they've got this huge capital base that they need to pull behind them.

The city relies on the sale of energy in order to meet its budget. So that I'm worried about because that means we're just going to massively increase our rates. But on the energy landscape, I think we'll get there. I think we're going to end up in a sustainable energy mix because Eskom put us in a crisis. There's a saying like, you never waste a good crisis. And so they put us in crisis. And so we are going to be, you're going to have to get really smart about it.

You know, when they cut off water, you get smart about how you get water, everybody gets their JoJo tanks, everybody gets their this. It's just like the externalizing the cost to people. That's the issue that I have. I do think it'll come right to some extent, but it is going to look very different. There is going to be a solar panel on everything. There is going to be a solar panel on every window that's going to start generating, you know, there's going to be, I don't know, all kinds of different and odd ways that we're going to figure it out. So I'm not too worried about that. The just energy transition, though, I

think is bull****, but that's just me. I think it's some nonsense idea that's been pushed onto us by Europeans who feel guilty about what they've done and now are trying to force us into a corner and promising money that they'll never actually give us. So that's what's, so I hate the concept of a just energy transition because I think it's a false narrative, but that's my own scepticism about development finance globally.

MS: No, fair enough. I also think that our country signs so many agreements just to keep the relationships with other countries.

NRP^{6}_{IL}: So look, I used to work in a place that did this. So when I was at the World Bank, we would, there's certain like programs that you push. We're always pushing sustainability. You always want this. You always want whatever. And I was told, this was in solid waste, actually. I was doing a solid waste project in Bosnia and somebody said to me, you must remember that Bosnia cannot afford to recycle. I was like, hmm, that's interesting. They're like, it is expensive to do that. It is cheaper to put things in a landfill, which makes sense. The cheapest thing is to throw something, to throw your litter on the road. That's the cheapest thing for you, right?

And to do this and to start, because it's also about the whole value chain of like separating your waste, doing all of that. Who's going to do it? Who's going to pay for it? Is it the city? The city now needs a recycling facility instead of just a landfill. End of this, end of that. And you can argue the environmental benefits, the social benefits, blah, blah. We used to do that all the time. But the reality is that it is cheaper for us to burn coal. Of course, that's why we keep doing it. That's why we keep doing it. And so the forcing us into what they believe is a just energy. I don't even know why it's named just energy. It's a lie. It's them making sure that our carbon emissions stay low so that they can continue polluting. That's my cynical view on this. So the just energy transition is nonsense.

So I think that the just energy transition is nonsense. And it's just like a European narrative that's been pushed onto us. But I do think that we will end up with a more sustainable energy mix. It's going to be more expensive. I don't think we can get away from that only because we failed as Eskom. We failed in delivering something. And so now we're plugging on a more expensive version of it in order to make things work. That's my, I'll end on this cynicism.

MS: Okay. I've also heard concerns about, I mean, this might be also more sceptical people, but concerns about like Eskom really…No one really stops them from doing anything.

So I've heard concerns about say, who's going to stop Eskom if everyone's going solar and everyone's kind of like, it's every man for himself. Who's going to stop ESCOM from implementing stuff like solar taxes or like wind taxes, like renewable taxes? I mean, they could, I don't know if Treasury would allow them to do that. But they would, I mean, they would consider it because

NRP$^{6}_{IL}$: The reality is, and cities are going to do it. They need to find their revenue somewhere. So they've got this huge capital base of things that's sitting in the background, right? They've got Komati, they've got this, they've got Medupi that they haven't paid. The World Bank, I think, funded that for them. There's a whole bunch of stuff that they've now, they've got this huge dragging capital base that they need to pay for. And either you sell your electricity more expensively or you find another income source or you shut it down.

Those are going to be the options. I think we are going to get to some really odd policy choices in the future where Treasury or somebody else goes, okay. Because even now the transmission, if they separate transmission from generation, transmission can now go, you know what, I'm going to give you a super cheap wheeling tariff. Because it's cool. I've got the distribution system. I just need to maintain it. So I just, I'll give you, I'll give it to you cheap. I don't have an issue with it.

Or they say, you know, it's better to do that than it is to actually buy. All that generation capacity has to be paid for. So I'm just going to pay for it because we're going to end up building more solar because it makes more sense too. And then suddenly there's what, I don't know, we're just going to have Medupi sort of rotting in the background. It's going to be really weird choices that I think we're going to end up making and we may just end up exporting again. It's going to be super odd. Or we're just going to end up buying it from Lesotho Islands project too. Just buying all the hydro that's going to come from them. I don't know. I don't know, it's going to be strange, strange policy choices that Cape Town's going to have exactly the same problem because they're reliant on that income. Yeah. But I do think that they're being proactive about it. Like they'd rather work with the people than let the people do the work first. And then they're like kind of, well, I'll give them that money off it now. Yeah. I will give them that. They, um, they've been a lot, they've been a lot more willing to like sort of break things than what other municipalities have, which I think makes it a little bit better off here. But I still think that for them, it's going to be, it's going to, it's going to bite a bit and they have, they're really starting to increase the rates in the Rand substantially. The industrial rate in the Rand went up 16%.

MS: That much?

NRP$^{6}_{IL}$: Go check. I saw it yesterday in the budget thing. I actually, oh wait, I actually, I literally even have it open here. It is going to go to 0.014742. Yeah. That is the new rate in the Rand. Um, which is going to, so all this year, they've decreased the value, the GV went down. Yeah. They increased the rate in the Rand. So that's probably going to end up at like a 5% up or so. Okay. Somewhere around there. Cause I know like. And you see as the valuations increase, then that rate in the Rand is going to murder everybody. That's, so I think that they're replacing the one for the other over like a medium-term expenditure framework.

MS: Okay. Well, that makes sense. Cause I know when we do DCFs, we kind of escalate the rates by about 6% annually.

NRP$^{6}_{IL}$: That's what I said too. I was like, it can't be more than that. It doesn't make sense. No, but now I know why it makes sense. They lowered the GV and in four years' time, they're just going to up it again. But this is the, so I, I think in like in a down cycle like this, it's optical, it looks really good politically to do that, but you increase your rate in the Rand. We don't feel it this year. It's election year. You don't feel it because the valuation goes down. And then the minute the valuations go up because of, I don't know, you do some stuff on the property, you do this, you do that valuation goes up and they're like, got you on the rate in the Rand.

Yeah, cause then it's going to be four years of escalating and like an escalating rate in the Rand. Yes. Okay. Well, I woke up cynical today. I don't know why. I mean, look, if I was the, if I was in the CFO's office there, I would do exactly the same thing. It's not a, it's not a not sensible thing to do, but it's, I don't know. I feel like we've been lulled into a false sense of security. Anyway, I woke up and chose violence this morning. So I hope your day ends better than it started. I'm going to do some income statements. Look at the financials. It'll end up better. Probably. Hopefully. I hope so.

MS: Okay. No further comments there. I think.

NRP$^{6}_{IL}$: No, I'm good. I think I've made enough comments for today.

MS: I think so too. Well, thanks so much, Gary. Sorry, we're about five minutes over time.

NRP$^{6}_{IL}$: No, that's fine. Good luck.

End of interview.