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Renewable Energy

MARKET
INTELLIGENCE REPORT

2025

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Market Intelligence Report
2025

RENEWABLE ENERGY

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ACKNOWLEDGEMENTS

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List of abbreviations and acronyms

BTM	Behind-the-meter
C&I	Commercial and industrial
CPI	Consumer price index
DEE	Department of Electricity and Energy
DFFE	Department of Forestry, Fisheries and Environment
EAF	Energy availability factor
EPC	Engineering, procurement and construction
ERA	Electricity regulation act
ESCo	Energy services company
ESG	Environmental social governance
GDP	Gross domestic product
IGCAR	Interim Grid Capacity Allocation Rules
IPP	Independent Power Producer
IRP	Integrated Resource Plan
kWp	Kilowatt peak
LCOE	Levelised cost of energy
MFMA	Municipal Finance Management Act
MIR	Market Intelligence Report
MtCO2e	Megatonnes of Carbon Dioxide-equivalent
NDCs	Nationally determined contributions
NERSA	National Energy Regulator South Africa
NTCSA	National Transmission Company of South Africa
O&M	Operations and maintenance
OEM	Original equipment manufacturer
PPA	Power purchase agreement
PV	Photovoltaic
REIPPPP	Renewable Energy Independent Power Producer Programme
SEZ	Special economic zone
SSEG	Small-scale embedded generation
TSO	Transmission system operator
WC	Western Cape

Exchange rate used: 1 USD = 18.40 ZAR

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EXECUTIVE SUMMARY

This market intelligence report (MIR) is written for local and foreign investors looking to invest in the renewable energy market in the Western Cape. It highlights opportunities in the province in embedded generation and behind-the-meter (BTM) storage, as well as in large-scale renewable energy.

Key developments influencing the renewable energy market in the Western Cape:

- More than nine months without loadshedding[1] in 2024 after unprecedented levels in 2023.
- Wheeling pilots by two municipalities (City of Cape Town and George) in their distribution areas.
- The Electricity Regulation Amendment Act 38 of 2024, which aims to liberalise the South African energy market, was signed into law.

This report discusses three investment opportunities in the renewable energy sector in the Western Cape:

1. Embedded solar photovoltaic (PV) for commercial, industrial, and agricultural applications;
2. large-scale renewable energy projects; and
3. large-scale BTM lithium-ion storage.

Figure 1 and Table 1 summarise the opportunities described in this report.

The business case for embedded solar PV for use in commercial, industrial, and agricultural settings is anchored in the cost savings made possible by rising energy costs paired with cost-competitive systems that are available through a variety of financing mechanisms.

BTM lithium-ion battery storage, particularly for large- to medium-scale energy users, is another promising area for growth in the energy sector in the province. Due to the competitive pricing of these systems and the opportunities for value stacking that they offer, users in the commercial, industrial, and agricultural sectors are adopting them to enhance energy resilience, reduce costs, and better utilise PV installations.

With significant efforts being made to alleviate grid congestion in the province, there is renewed potential for developing new large-scale renewable energy projects. Large-scale solar PV and wind projects can deliver competitively-priced power by making use of the province's advantageous wind and solar resources. The implementation of curtailment as a grid congestion management mechanism[2] can unlock 2 680 MW of grid capacity. This potential, paired with the increasing ease of access for private off-takers through energy aggregators that are entering the market, shows promise for growth in the sector.

ACCESS ONLINE CONTENT

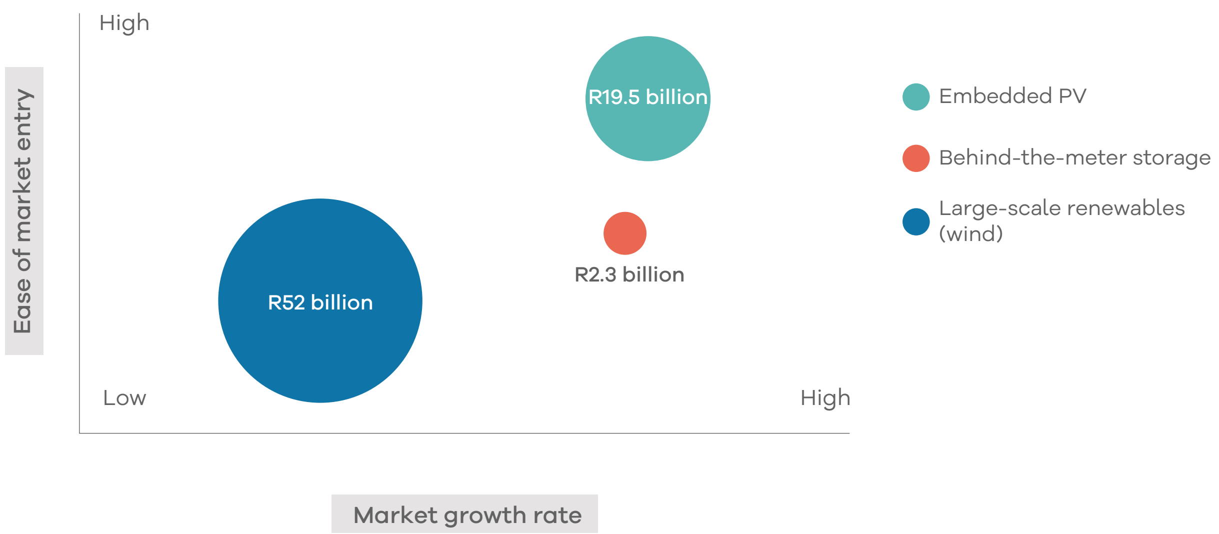

Figure 1: Market growth potential matrix of renewable energy opportunities in the Western Cape

1 Loadshedding is the practice of reducing load to match generation output by switching off electricity supply to customers in the form of planned outages.
2 Curtailment of renewable energy to manage grid congestion refers to the practice of limiting the output of renewable energy of certain generators in times when generation exceeds the amount of power that can be evacuated at a given time.

Table 1: Summary of opportunities within the renewable energy market in the Western Cape

OPPORTUNITY					
EMBEDDED SOLAR PV FOR AGRICULTURAL, COMMERCIAL, AND INDUSTRIAL USERS					
MARKET SIZE	**DRIVERS**	**BARRIERS**	**STAKEHOLDERS**	**TERM**	**MACRO CONTEXT**
Current size: R6 billion, 420 MW. 1 500 MW R20 billion total market size.	• Electricity price stability and savings through renewable energy. • Availability of attractive financing mechanisms (debt finance, power purchase agreements (PPAs), lease etc.). • Enabling distribution utility regulations (small-scale embedded generation (SSEG) feed-in tariffs in most Western Cape municipalities, energy banking for Eskom customers). • Prioritisation of energy security (due to experience during previous extended periods of loadshedding).	• Skills availability. • Increased administrative burden on municipalities causing delays in approval/registration of systems. • Distribution infrastructure challenges.	• Renewable energy (RE) developers. • Engineering, procurement, and construction (EPC) companies. • Commercial banks. • Western Cape local municipalities. • Solar PV equipment manufacturers and distributors.	Short-term (present)	Increased emphasis on decarbonisation from export markets.

OPPORTUNITY					
LARGE-SCALE RENEWABLE ENERGY					
MARKET SIZE	DRIVERS	BARRIERS	STAKEHOLDERS	TERM	MACRO CONTEXT
Current size: R21 billion, 1.4 GW installed capacity. R63 billion, 3.8 GW (project pipeline and grid capacity increase) growth potential over the next 10 years.	• Improved cost competitiveness of renewable energy technology. • Enabling environment for wheeling (virtual) and energy trading. • Carbon emissions reduction targets for large power users. • Plans to increase grid capacity.	• Grid constraints. • Policy uncertainty • Current lack of frameworks, internal capacity in municipalities for wheeling to municipal customers.	• Developers • Independent power producers (IPPs) • EPCs • Energy-intensive users • Energy traders • Financiers • Eskom • National Energy Regulator of South Africa (NERSA) • Municipalities	Medium-term (3-10 years)	Increased emphasis on decarbonisation from export markets. Western Cape Energy Resilience Programme.

OPPORTUNITY					
BEHIND-THE-METER STORAGE (C&I)					
MARKET SIZE	DRIVERS	BARRIERS	STAKEHOLDERS	TERM	MACRO CONTEXT
Current size: approximately R750 million, 170 MWh R2.3 billion, 540 MWh anticipated market size by 2030.	• Improved cost competitiveness of battery energy storage • Value stacking options for batteries (tariff optimisation, peak-lopping, improved utilisation rates of RE installations) • Requirement for energy security and quality (loadshedding)	• Nascent regulatory environment creating uncertainty • High reliance on imported components	• Developers and installers • Battery energy storage system equipment manufacturers and distributors • Commercial and industrial (C&I) customers • Commercial banks • Eskom • Municipalities • NERSA	Short to Medium-term (present – 10 years)a	Downward trend of battery storage costs worldwide

WHAT'S NEW?

Several key developments in the energy sector took place in 2024 which affect the nature of the energy market in the Western Cape.

There have been notable changes in the energy sector with relevance to the Western Cape that took place during 2024.

January:
Department of Mineral Resources and Energy publishes 2023 Draft Integrated Resource Plan for public comment.

February:
Eskom publishes addendum to Generation Connection Capacity Assessment 2025 that lays out potential to open up 2 680 MW of grid capacity in the Western Cape by using curtailment as a grid congestion management mechanism.

March:
Loadshedding is suspended after unprecedented levels in 2023.

April:
Eskom reports a doubling of installed capacity of embedded solar PV in the Western Cape compared to the installed capacity a year prior.

June:
South Africa imposed a 10% import duty on PV panels.

July:
Eskom's curtailment for congestion management proposal enters public consultation phase through the NERSA.

September:
Western Cape Government establishes Energy and Water Council with the goal of bolstering the province's energy and water security.

October:
Construction begins on first city-owned PV plant (7 MW_p) in South Africa for City of Cape Town.

November:
Revised 2024 Integrated Resource Plan presented for comment.

1

INTRODUCTION AND PURPOSE

This MIR is compiled for foreign and local investors (persons or organisations) looking to invest in the renewable energy market in the Western Cape. This MIR provides potential investors with an overview of emerging market opportunities, in the renewable energy market in the province.

In 2024, the renewable energy market in the Western Cape showed resilience, sustaining its growth despite the challenges facing a fast-growing industry and the absence of loadshedding[3], which has historically been a major driver for growth in embedded projects in particular.

Eskom's proposal for curtailment[4] offers the opportunity for new projects to be developed in the Western Cape, where a lack of grid capacity has slowed growth in the large-scale renewable energy market. Along with project developers having better access to the grid, the registering of new energy traders and the commencement of virtual wheeling offer improved access to potential offtakers for large-scale projects.

There has been significant uptake in embedded solar PV by medium- to large-scale energy users such as industrial, commercial and agricultural businesses with a business case anchored in energy cost savings allowed by the competitive costs and financing and the rising prices of grid electricity. As a complement to this, the installation of Lithium-ion batteries by these energy users provides value stacking opportunities.

In the cases of both the large-scale and embedded solar PV markets, policy uncertainty and a nascent regulatory environment are key areas to be addressed to enable the meeting of market demand as well as South Africa's decarbonisation obligations as a signatory to the Paris Agreement.

In addition to this report, GreenCape also published a market intelligence report for the water sector in the Western Cape. National market intelligence reports on opportunities in the energy services, large-scale renewable energy, and sustainable mobility sectors are also available on the GreenCape website.

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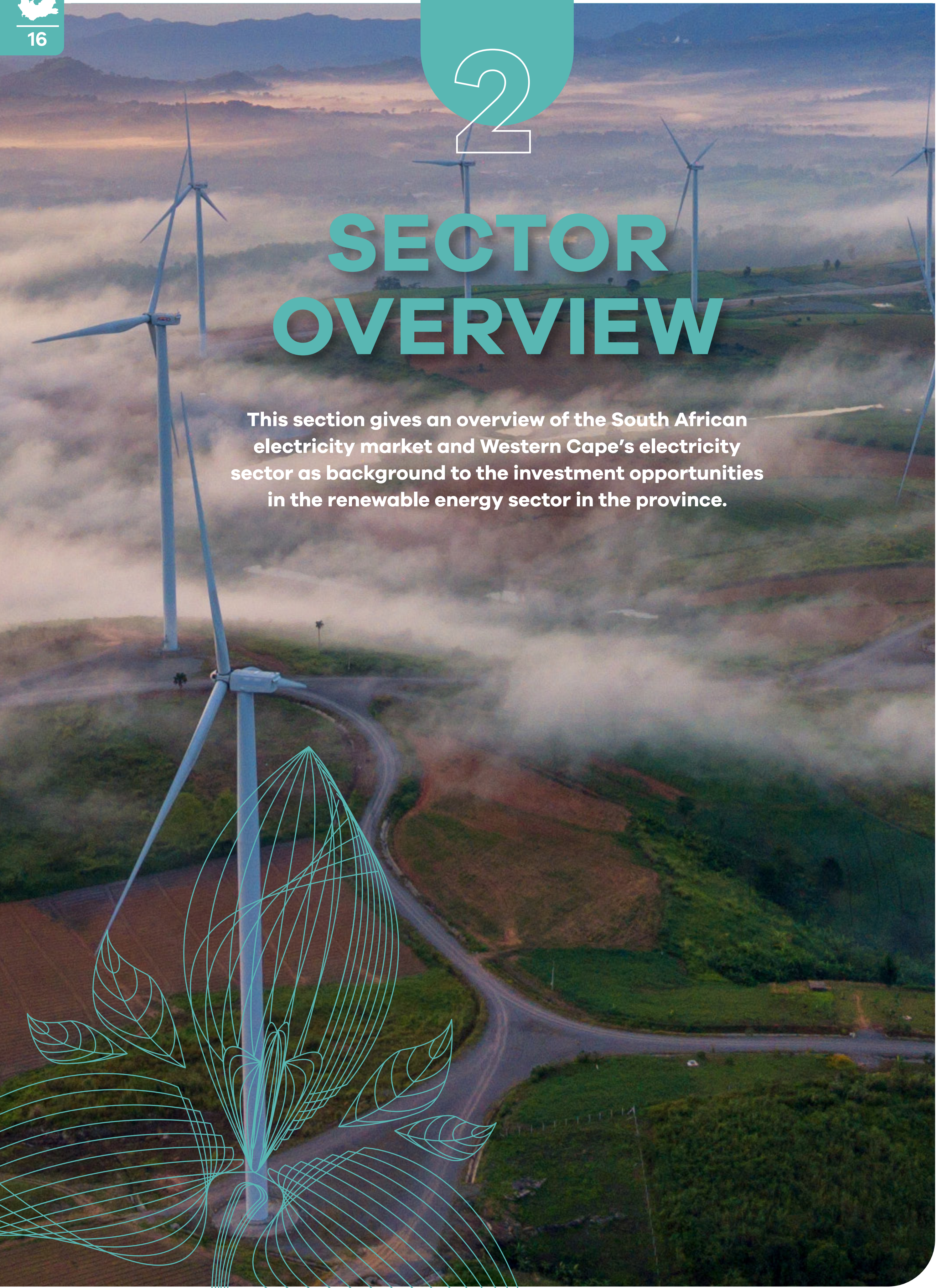
3 Loadshedding is the practice of reducing load to match generation output by switching off electricity supply to customers in the form of planned outages.

4 Curtailment of renewable energy to manage grid congestion refers to the practice of limiting the output of renewable energy of certain generators in times when generation exceeds the amount of power that can be evacuated at a given time.



2

SECTOR OVERVIEW

This section gives an overview of the South African electricity market and Western Cape's electricity sector as background to the investment opportunities in the renewable energy sector in the province.

2.1. South African electricity landscape

South Africa's electricity landscape is transitioning from a vertically integrated model, historically managed by the state-owned entity Eskom, to a more liberalised framework. The network now includes cross-border electricity imports, IPPs, municipal distribution network owners, private distribution networks, and private traders. While Eskom remains a major player, it now competes within a more diverse and decentralised market. Power generation is predominantly from Eskom's coal-fired power generation (Figure 2). However, the renewable energy sector is a rapidly growing sector enabled by changes in South African electricity policies. To reduce fossil fuel reliance and diversify the country's energy mix, the government launched the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in 2011, with the primary goal of securing energy from renewable sources and promoting their development through private sector involvement. The goal of the programme has been to increase renewable energy generation and attract private investments by allowing private entities to sell electricity to the national grid.

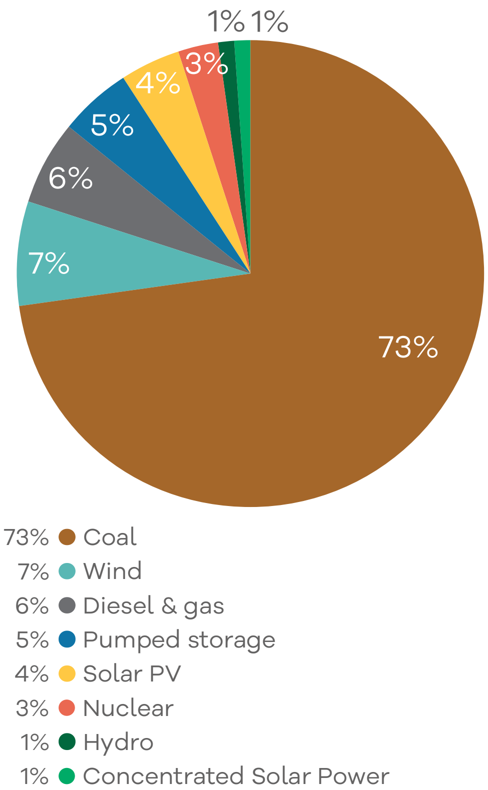


Figure 2: South African energy mix by installed capacity, not including embedded generation or private capacity

Source: CSIR, 2023

The contribution of coal to South Africa's energy mix is set to decline due to the ageing coal fleet being decommissioned as the plants reach their end-of-life, and due to the increased international and local pressure to reduce carbon emissions and improve air quality near the power plants. South Africa is a signatory to the Paris Agreement, which seeks to limit global warming to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. Under its Nationally Determined Contributions (NDCs), South Africa set targets for 2025 and 2030 following its communication of an in principle commitment to net zero submitted to the United Nations Framework Convention on Climate Change in 2020. This has spurred the need for renewable energy expansion to meet these targets, furthermore, the condition of the coal fleet has deteriorated resulting in a lack of available plants, resulting in a historical supply and demand imbalance.

The supply and demand imbalance resulted in intensive rolling blackouts, locally referred to as loadshedding. Loadshedding is the practice of reducing load to match generation by switching off electricity supply to customers in the form of planned outages. In 2023, South Africa experienced intensified loadshedding, as can be seen in Figure 3. However, lower levels and hours of loadshedding were experienced in 2024 with loadshedding being suspended in late April of 2024 due to improved generation performance and efficiency in maintenance practices.

Despite the suspension of loadshedding, Eskom resumed load reduction[5] in July 2024 to address network overload caused by electricity theft, particularly in areas like the Western Cape.

The degradation of Eskom's coal fleet is illustrated through the energy availability factor, (EAF[6]). The EAF declined from approximately 94% in 2002 to approximately 56% in 2023, but recovered to 64% in 2024 (Eskom, 2024a). This is, however, still below the mandated EAF target of 75%. Many of Eskom's coal power plants have reached their design end-of-life and are becoming less reliable and prone to breakdowns. This underlying challenge still needs to be addressed, posing a continued risk of loadshedding in the future. It also indicates that new generation is required to mitigate future electricity supply shortages.

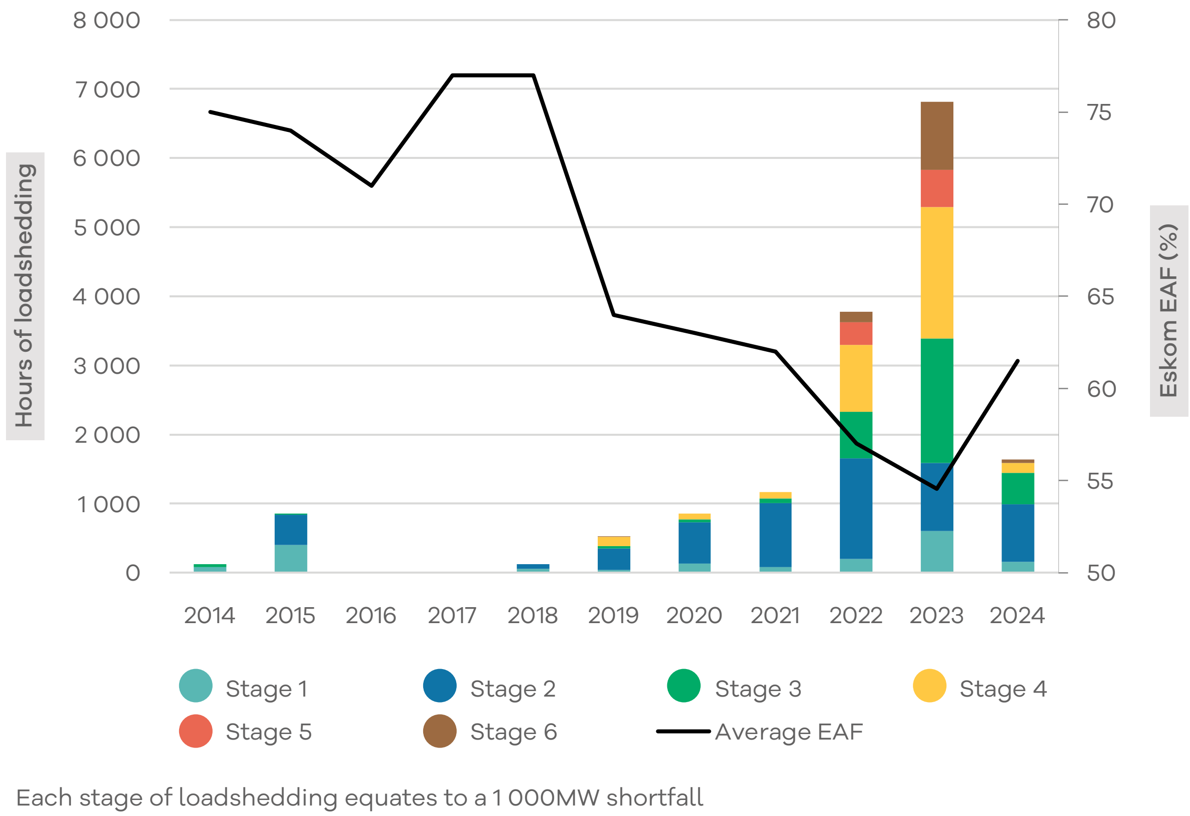


Figure 3: National loadshedding hours and Eskom energy availablity factor trend from 2014 to 2024
Sources: Adams, 2024; Centre for Renewable & Sustainable Energy Studies, 2024; Eskom, 2024a

2.2. Western Cape overview

The Western Cape is a province located in the South-Western region of South Africa.. It has a population of approximately 7.4 million people (Statistics South Africa, 2024) spread across 25 municipalities (Figure 4); with an unemployment rate of 20.3% (2023, Q4) , the lowest in the country. The province contributes approximately 14% to the national GDP, with finance, real estate, business services, and manufacturing making up the first and second largest sectors of its economy, respectively. (Wesgro, 2023)

5 Load reduction is the practice of reducing the load in areas where distribution infrastructure is at a risk of being damaged from overloading by switching off supply to the at-risk area.
6 The EAF is the ratio of available energy generation to maximum amount of energy which could be produced.

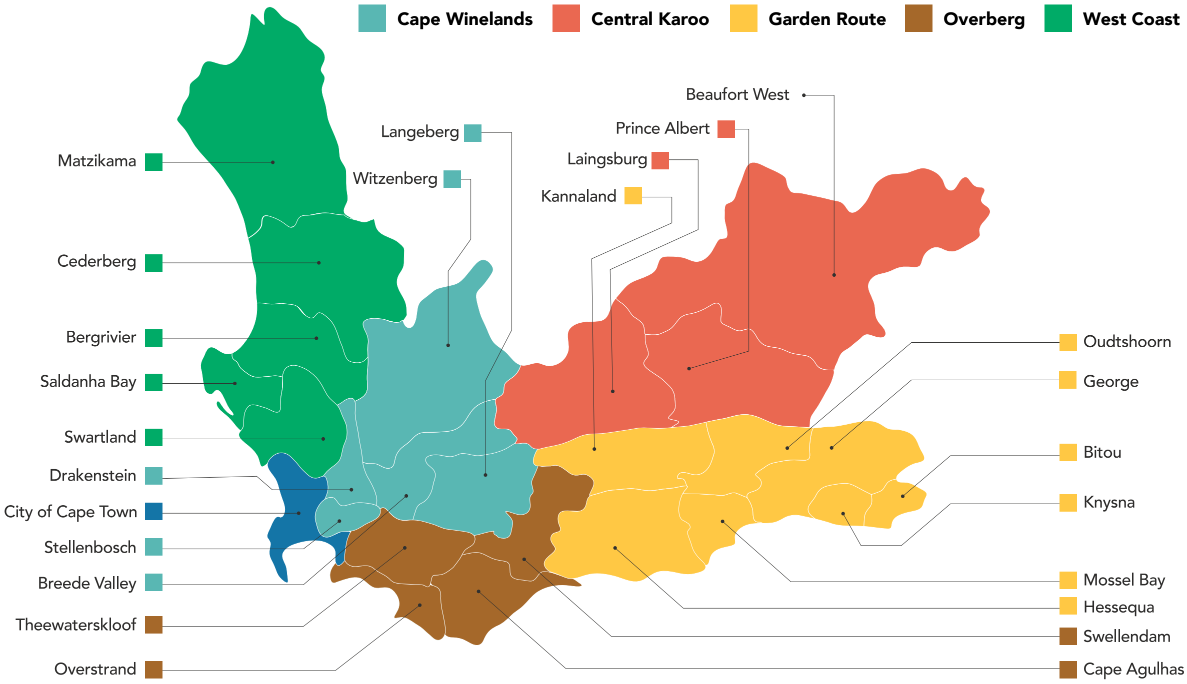


Figure 4: Local municipalities of the Western Cape Province

The Western Cape is Africa's leading green economic hub and has established several strategic frameworks to achieve this goal. It was the first province in South Africa to develop a Sustainable Energy Strategy in 2008 and introduced a Green Economic Strategy Framework (2013) focused on job creation and building an environmentally sustainable economy. To support these objectives, the province is strengthening institutional capacity and creating a supportive policy environment (see Table 2 for policies and strategies specific to renewable energy adoption).

Table 2: Strategic frameworks and initiatives towards increasing renewable energy adoption in the Western Cape

STRATEGY/INITIATIVE	DESCRIPTION
Western Cape Climate Change Response Strategy: Vision 2050 (2022)	Comprehensive framework aimed at ensuring the province's resilience to climate change while transitioning to a low-carbon economy. The strategy envisions a future where the Western Cape is powered by 100% renewable energy, has achieved net-zero carbon emissions, and has resilient infrastructure and communities capable of withstanding climate impacts.
Energy Security Game Changer: 2015-2020	The initiative focused on promoting renewable energy adoption, improving energy efficiency, and ensuring a stable electricity supply for businesses and households. The program aimed to create a more resilient energy system by supporting the development of IPPs and municipal energy projects that diversified the province's energy mix.
Western Cape Energy Resilience Programme (2022-)	Designed to enhance the region's energy security and promote the transition to renewable energy sources, this initiative encourages Western Cape municipalities to diversify energy sources, while also supporting SSEG projects.
Western Cape Sustainable Energy Strategy (2008)	The comprehensive plan aimed at accelerating the adoption and integration of renewable energy sources in the province. The strategy seeks to enhance energy security, reduce reliance on Eskom, and support South Africa's transition to a low-carbon economy. Key elements of the strategy include fostering public-private partnerships, encouraging investment in renewable energy infrastructure, and enabling municipal energy resilience by supporting municipalities to generate or procure energy independently.

The provincial large-scale renewable energy sector has experienced substantial growth from the energy projects awarded in the province under the REIPPPP, further driving economic growth and development. A total of 1097 MW of procured capacity is situated in the Western Cape across a total of 16 projects for the bid window (BW) 1 to BW5 period (Independent Power Producers Office, 2024). 24 projects with a capacity of 4 791 MW in the Western Cape have been submitted to REIPPPP BW6 (DMRE, 2022), with none being assigned preferred bidder status as of the end of 2024. Furthermore, in BW7 of the programme, there were no bidders located in the Western Cape, where grid capacity for new projects is constrained.

2.3. Key stakeholders

The renewable energy sector in South Africa is experiencing a transformative shift driven by regulatory changes, technological innovations, and increasing demand for reliable clean energy. Several key stakeholders are at the forefront of navigating this changing landscape and driving the development of the sector. These include government and regulatory bodies that establish policies and frameworks to facilitate the growth of the renewable energy sector (Table 3). When considering investing in the renewable energy sector in South Africa or installing renewable energy, it is important to understand which organisations govern the operation of the sector and how the different stakeholders interact with each other. Figure 5 gives an overview of the electricity landscape within South Africa, at the time of writing.

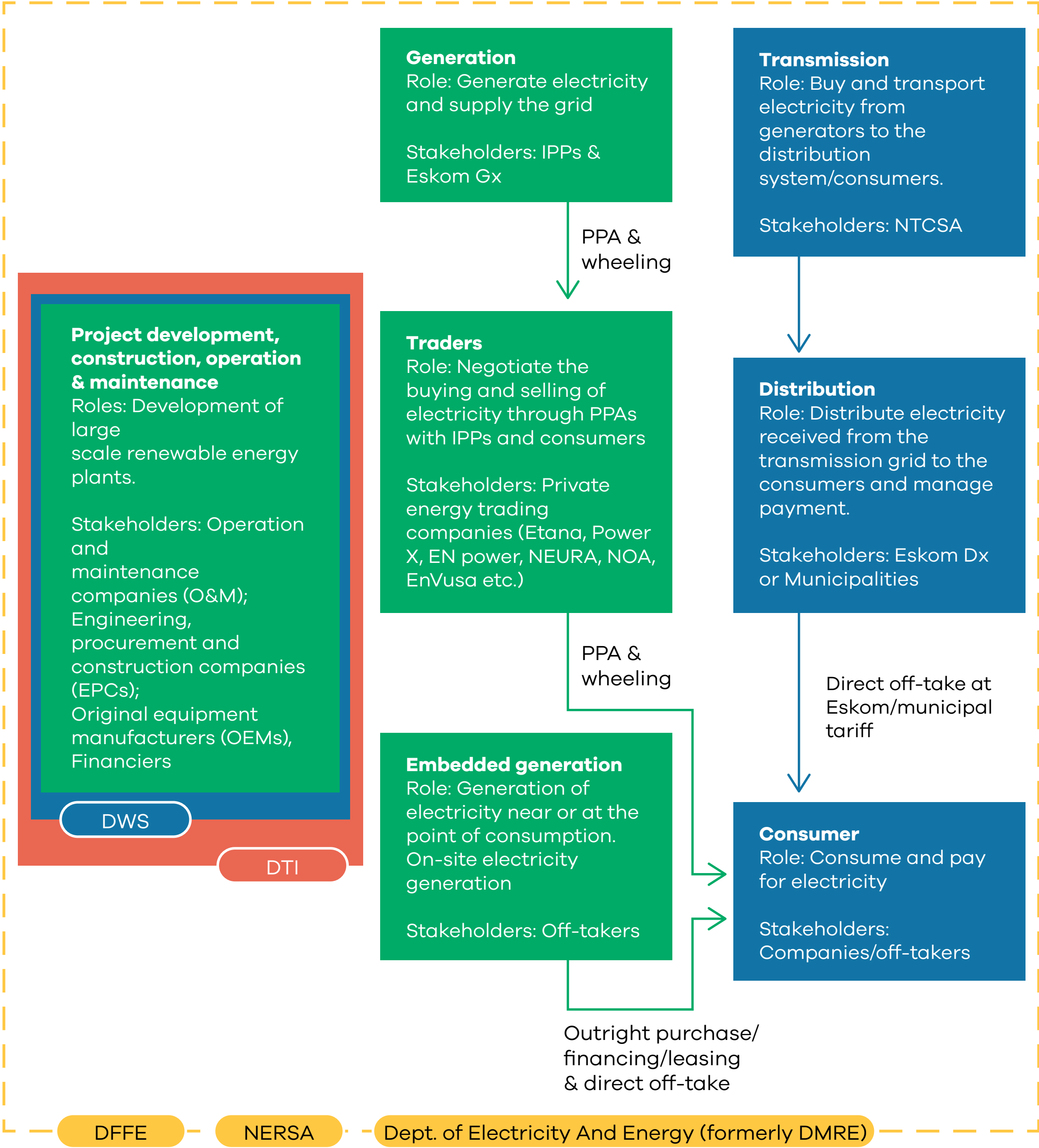


Figure 5: South African electricity landscape

The national government, through the Department of Electricity and Energy, is responsible for energy planning, policy implementation, and regulatory compliance. This includes overseeing policies, programmes, plans and related entities such as the the National Energy Act (NEA) 34 of 2008, the Integrated Resource Plan[7] (IRP) and the Independent Power Producer Office (IPPO).

7 The IRP specifically outlines the planning, sourcing, and quantities of electricity generation sources contributing to the country's generation mix.

Various agencies, including Eskom, NERSA, and the National Transmission Company of South Africa (NTCSA), manage energy generation, distribution, and transmission. Local municipalities handle the distribution of electricity to consumers within their areas although some customers are served directly by Eskom. Additionally, private entities such as IPPs, Original Equipment Manufacturers (OEMs), EPC contractors, and energy traders play crucial roles in project execution and electricity trading. Some detail on key stakeholders is captured in Table 3.

Table 3: Government and regulatory bodies key to the renewable energy sector in South Africa

STAKEHOLDER	FUNCTION
Department of Electricity and Energy (DEE)	The DEE is responsible for the development and implementation of energy policies to provide secure, affordable clean energy and promote energy security and grid stability.
Oversee the IRP for renewable energy targets and the and REIPPPP for public procurement of renewable electricity.	The initiative focused on promoting renewable energy adoption, improving energy efficiency, and ensuring a stable electricity supply for businesses and households. The program aimed to create a more resilient energy system by supporting the development of IPPs and municipal energy projects that diversified the province's energy mix.
The National Energy Regulator of South Africa (NERSA)	Regulates the electricity sector and issues licences for the generation, distribution, and transmission of electricity. NERSA approves electricity tariffs and the conditions under which electricity may be sold.
Department of Forestry, Fisheries and Environment (DFFE)	Responsible for environmental regulations, compliance of energy projects to promote sustainability and conservation of natural resources.

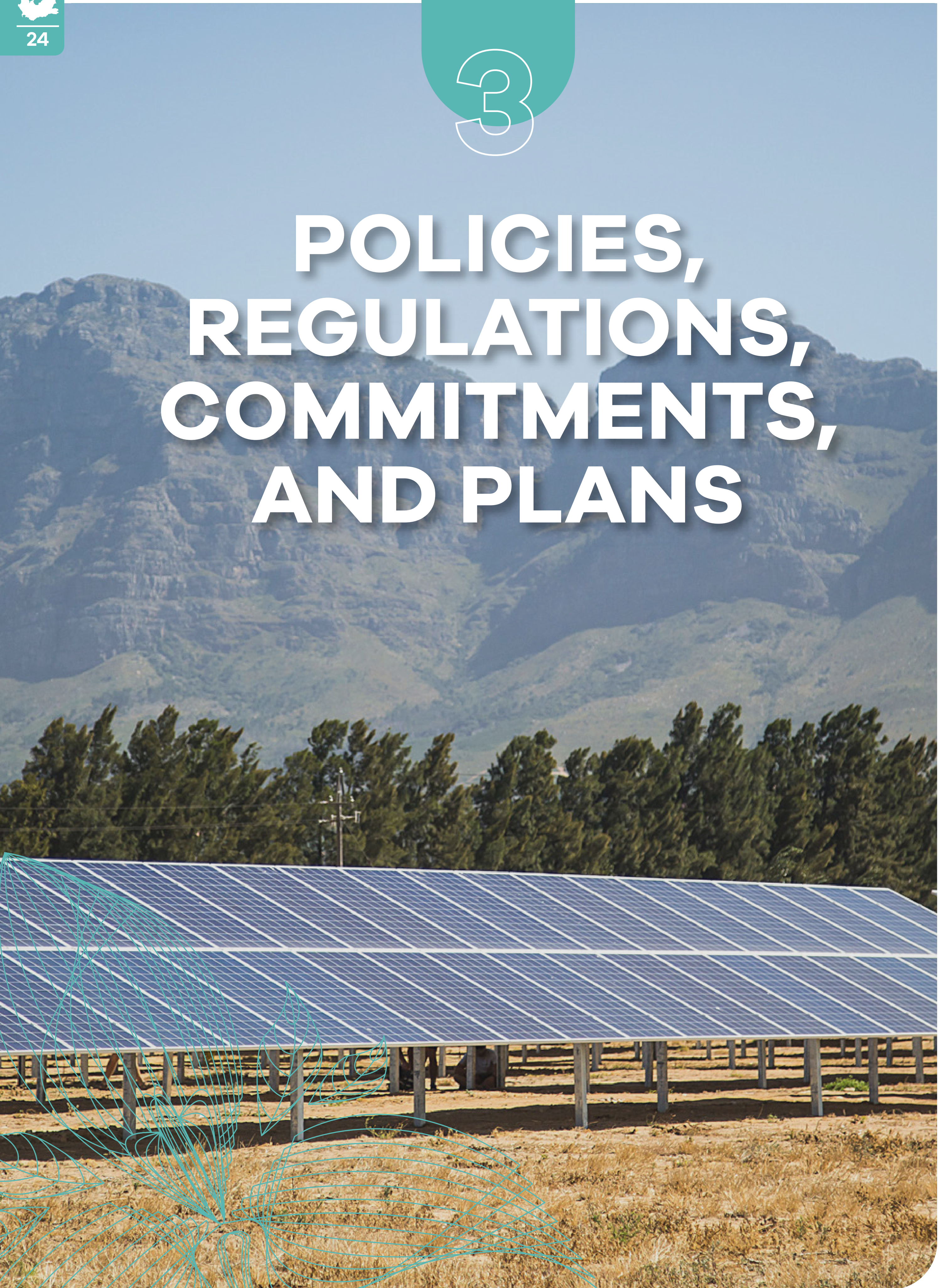
Stakeholders in the renewable energy industry that emerged in response to the demand for large-scale and embedded renewable generation and storage and the constantly changing landscape can be classified into various categories based on their roles (Table 4). These key players each contribute according to their specific role in the ecosystem enabling the uptake of renewable energy in South Africa.

Table 4: Key stakeholders in the renewable energy industry

Independent Power Producer – IPP	Responsible for project inception and development, land acquisition, finance sourcing, bid submission, and securing power purchase agreements. Project stages involved: Project development, project construction and project operation.
Operation and Maintenance Company – O&M	Responsible for managing the lifecycle of key components to ensure long-term efficiency and reliability of the energy systems. Project stages involved: Project operation and maintenance.
Original Equipment Manufacturer – OEM	Responsible for the manufacturing and supply of key technologies. They provide technical support and ensure the efficiency of the key technologies manufactured. Project stages involved: Project procurement, construction, installation, operation and maintenance.
Engineering, Procurement and Construction – EPC	Responsible for managing the entire lifecycle of a project ranging from design to operation. Project stages involved: Project development, procurement, construction and installation.
Grid Operators and Energy Distributors	Responsible for managing the transmission and distribution of energy to customers and integrating renewable energy into the national grid. Project stage involved: Operation and maintenance.
Energy Aggregators	Act as intermediaries, buying electricity from IPPs and selling it to multiple consumers, or off-takers, through wheeling. Project stages involved: Project development (by engaging with IPPs), and operations and maintenance.
Energy Services Companies – ESCo	Responsible for developing and providing energy solutions that either provide energy or target the reduction energy consumption, or operation and maintenance costs associated with energy. Project stages involved: Project development, project construction, and operations and maintenance.
Financiers	Responsible for providing funding and financing mechanisms to realise projects. Project stages involved: Project financing and development.

3

POLICIES, REGULATIONS, COMMITMENTS, AND PLANS



South Africa's policy landscape is a dynamic environment that is increasingly shifting towards the liberalisation of the electricity sector driven by the need to mitigate the country's energy challenges. This change is evident through recent amendments to the Electricity Regulations Act, which among others, enabled more private participation in the electricity market and allowed for further unbundling of Eskom into separate entities representing generation, transmission, and distribution. For the Western Cape, this liberalisation creates opportunities to accelerate renewable energy adoption and reduce reliance on Eskom, as private sector investment in local energy generation and distribution becomes more feasible. It also positions the province to take proactive steps in meeting both its own energy needs and South Africa's climate commitments, by fostering a more competitive and flexible energy market.

3.1. Electricity Regulation Amendment Act

Electricity Regulation Amendment (ERA) Act of 2024 signed into law in August 2024, amends the ERA of 2006. The legislation establishes the Transmission System Operator (TSO) as an independent entity to be created within five years, with the NTCSA acting as the interim TSO. It also facilitates an open market platform for competitive wholesale and retail electricity trading and introduces market operation as a new licensed activity overseen by NERSA. The Act mandates the development of a market code to govern the competitive market, providing a structured approach to market operations. This opens up new pathways for increased competition, reduced energy costs, and increased investments in new generation capacity (South African Government Communications and Information, 2024).

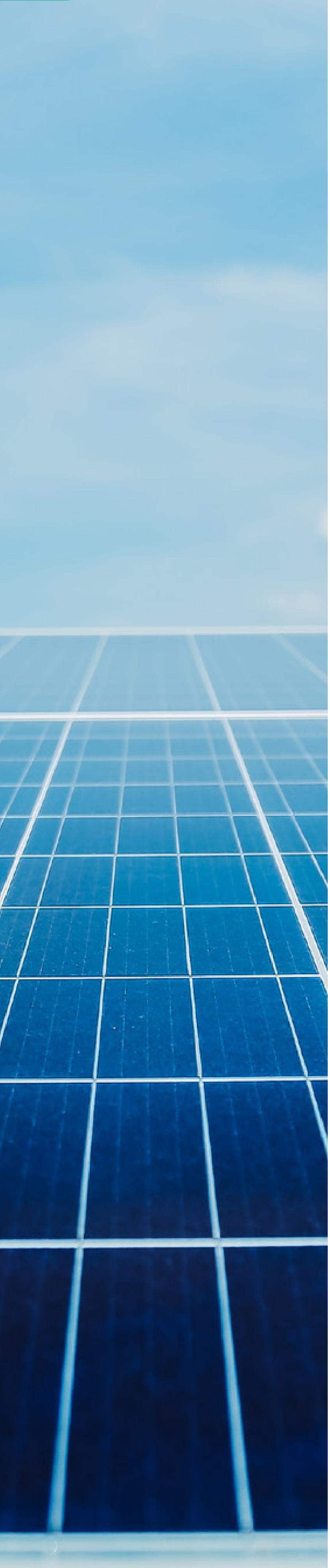
3.2. Climate Change Act

The Climate Change Act of 2024 is aimed at addressing climate change and steering the country toward a low-carbon and climate-resilient future. Signed by President Cyril Ramaphosa in July 2024, the act provides a legal framework for a coordinated national response to climate change. It focuses on both mitigation and adaptation, aligning South Africa's actions with its commitments under the Paris Agreement. This will have a transformative impact on the energy landscape by accelerating the country's shift toward cleaner energy sources and reducing reliance on coal and fossil fuels.

3.3. Carbon Tax Act

The Carbon Tax Act of 2019 imposes a tax on the Carbon Dioxide equivalent of greenhouse gas emissions, adhering to the "polluter pays" principle. During the 2024 National Budget Speech, an increase in the Carbon tax rate from R159 to R190 per tonne of CO_2-equivalent, effective 1 January, 2024, was announced. Additionally, a higher tax rate of R640 per tonne will apply to emissions exceeding carbon budgets[8], effective January 2025. In an amendment to the act, the government also raised the threshold for eligible renewable energy projects for the carbon offset allowance from 15 MW to 30 MW, effective 1 January, 2024. This encourages the transition towards renewable energy and attracts investment through enabling participation in international carbon markets.

8 Carbon budgets are the maximum amount of greenhouse gases that can be emitted by a company in a prescribed period of time, the nature of these budgets and how they are determined is under development by the DFFE.



3.4. South Africa's Nationally Determined Contributions under the Paris Agreement

South Africa submitted its first NDC on 1 November 2016, outlining its pledge to transition to a lower-carbon economy. The NDC covers adaptation, mitigation as well as finance and investment requirements. South Africa committed to reducing greenhouse gas emissions to net zero by 2050. This is driving the national transition towards decarbonisation and cleaner energy alternatives.

In March 2021, South Africa launched its updated draft of the NDC for public consultation. The finalised targets, which were approved by the Cabinet in September 2021, indicated South Africa's intention to limit green house gas (GHG) emissions to 398-510 $MtCO_2e$ by 2025, and to 350-420 $MtCO_2e$ by 2030. This is significantly lower than the mitigation targets communicated in 2016. These new targets will also see South Africa's emissions decline in absolute terms from 2025, a decade earlier than planned.

3.5. Integrated Resource Plan

This is South Africa's long-term electricity generation expansion plan, designed to ensure a balanced, least-cost energy supply while meeting government goals of energy supply security, affordability, and carbon emissions reduction. It outlines the future mix and sourcing of electricity generation for the country. A draft of the most recent iteration of the document was released in November 2024 for comment. The 2023 IRP was subject to significant scrutiny due to a lack of clarity over the assumptions made for the model and the incongruent results presented in the document, causing it to be revised. The IRP can serve as a driver for the transition towards renewable energy by allocating capacity for renewable energy sources and promoting energy security and affordability. As the IRP largely determines South Africa's planned generation mix, without an updated IRP, the overall national strategy for the procurement of renewable energy remains unclear, causing market uncertainty.

3.6. Municipal Financial Management Act

The Municipal Finance Management Act (MFMA) of 2003 has the primary objective of ensuring sound and sustainable management of the financial affairs of municipalities and municipal entities. It provides a framework for the financial oversight of municipal revenues, expenditures, assets, and liabilities and governs procurement. For municipalities to procure renewable energy, the MFMA provides financial and regulatory frameworks to enable municipalities to enter into PPAs or procure services to build renewable energy facilities.

4

INVESTMENT OPPORTUNITIES

This section covers key opportunities for investment in the renewable energy sector in the Western Cape, namely embedded solar PV (for agricultural, commercial and industrial users), large-scale renewable energy, and BTM storage.

Each opportunity is discussed in terms of:

- The investment opportunity: Describes the nature of the opportunity as well as the size of the market and how it is anticipated to grow.
- Market drivers: Highlights the factors that make the investment opportunity attractive.
- Market barriers: Highlights factors that presently slow or impede the growth of this opportunity.

Embedded solar PV represents a particularly strong investment area for agricultural, commercial, and industrial users who are looking to reduce operating costs and secure energy resilience. With the Western Cape's abundant sunshine and rising energy costs nationally, businesses across sectors see embedded solar PV as a practical solution to lower electricity bills, mitigate risks, and support sustainability goals.

Large-scale renewable energy projects present another key investment opportunity. These projects, typically wind and solar PV farms, benefit from policy support aimed at diversifying South Africa's energy mix, reducing dependency on fossil fuels, and achieving climate targets. The Western Cape's supportive policies and skilled labour market make it well-placed for hosting such projects, which have wider economic benefits in including job creation in urban and rural areas of the province.

BTM storage solutions complement these renewable energy investments by enhancing energy security and efficiency. Storage allows businesses to store excess energy generated during peak sunlight hours, using it later when demand is higher or during outages. As technology costs decline and energy security becomes more critical, storage investments offer both a financial and operational edge to Western Cape businesses.

4.1. Opportunity 1: Embedded solar PV systems for agricultural, commercial, and industrial users

Embedded solar PV systems, integrated directly with a customer's electrical infrastructure, offer a cost-effective solution to rising energy costs and the challenges of grid instability. These systems are adaptable, capable of being installed in multiple configurations, whether on existing rooftop spaces, ground-mounted setups, carports, or other available surfaces. This flexibility allows businesses and other users to customise embedded solar PV installations to their specific site layouts (as described in Table 5), making embedded solar PV a versatile option across the agricultural, commercial, and industrial sectors. Sustained efforts towards implementing enabling policies and the development of a diverse array of financing mechanisms have helped to aid growth in the sector.

Table 5: Configuration of embedded solar PV installations

TYPE OF PV SYSTEM	DESCRIPTION
Rooftop	Most common type of system due to the availability of roof space, typically accommodating 2 kWp per 10 m².
Rooftop (with asbestos replacement)	Asbestos Abatement Regulations 2020 phase out this roofing type, requiring roof replacement. Financiers and insurance providers often avoid funding installations on asbestos roofs due to long-term risks.
Ground-mount	Suitable if there is available land area

TYPE OF PV SYSTEM	DESCRIPTION
Floating	Applicable if there is a compatible body of water (manmade reservoirs with a low levels of disturbance); there is a cost premium that arises from the required floats.
Carport	Depends on the parking area and the influence of existing vs. required parking infrastructure on mounting costs. Offers the added benefit of providing shade.

4.1.1 Investment opportunity

The market segmentation for embedded solar PV in the Western Cape is provided in **Figure 6**. Approximately 440 MW of embedded generation capacity is installed across the commercial and industrial (C&I), and agricultural sectors, which are among the most promising areas for embedded generation. Businesses in these sectors tend to have high energy consumption and a need for energy security, making the case for embedded solar PV systems compelling. Additionally, increasing local and international pressure to reduce carbon emissions is driving businesses to invest in sustainable energy solutions. In agriculture, solar PV is particularly beneficial for powering energy-intensive irrigation and cold storage, helping farmers reduce costs and maintain production stability. The commercial and industrial sectors similarly gain from PV systems through reduced operational costs, enhanced energy security, and improved sustainability credentials. With potential available roof space, open land, and other infrastructure, these sectors are well-positioned to capitalise on solar PV for reliable, renewable energy.

The estimated value of this existing market in the Western Cape is R6 billion with 440 MW installed capacity in the agricultural and C&I sectors. The total value of this opportunity in the Western Cape is anticipated to grow to approximately 1 500 MW (R20 billion) by 2030.[9]

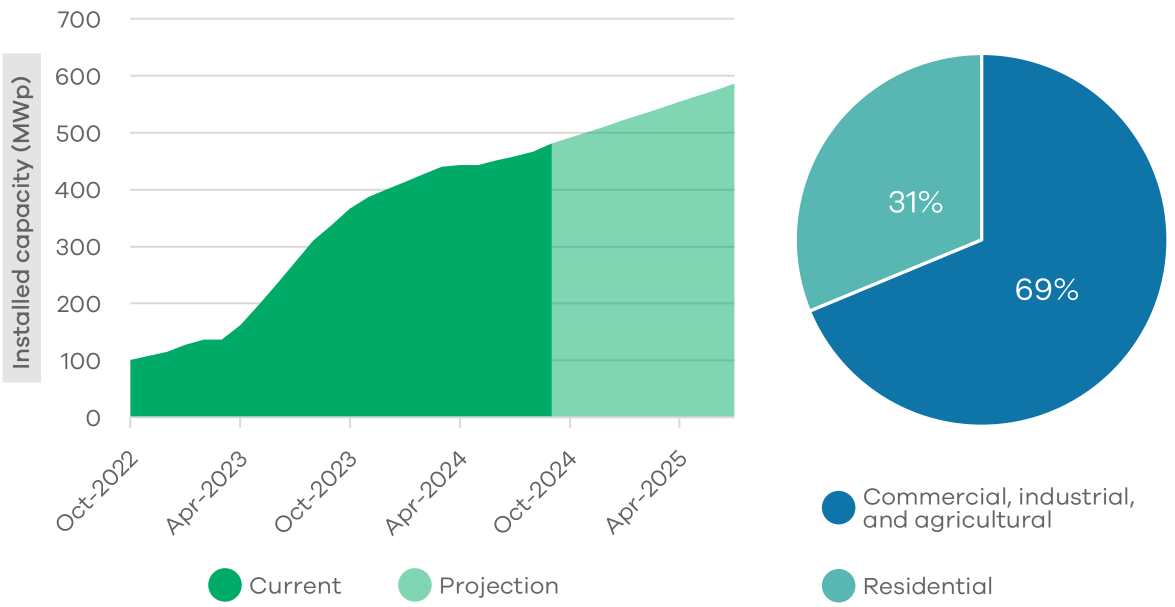


Figure 6: Market breakdown of embedded solar PV market in the Western Cape
Sources: Eskom, 2024a; SAPVIA, 2024

9 Based on the total addressable market of 10GW, nationally, and the Western Cape consuming roughly 15% of SA's electricity. R14/Wp

4.1.2 Drivers

The installation of embedded solar PV systems for C&I and agricultural customers is driven by a need for price stability, more reliable electricity supply and lower cost electricity that are enabled through a variety of financing mechanisms. The push for renewable energy uptake in South Africa is also being driven by several international and local carbon regulations that aim to reduce carbon emissions and transition economies towards cleaner energy sources. The investment case for these systems is enhanced by the enabling regulations of distribution operators.

4.1.2.1 Electricity price stability and savings through renewable energy

Rapidly rising electricity prices have increased the demand for more affordable alternative energy sources. When comparing Eskom's historical price increases to South Africa's inflation rate as reflected in the consumer price index (CPI), electricity prices for agricultural, commercial, and industrial customers have risen over 700% in nominal terms and tripled in real terms since 2005, as illustrated in Figure 7. This consistent increase in tariffs and long term price uncertainty has motivated customers in the commercial, industrial, and agricultural sectors to invest in embedded generation to save on their electricity costs and improve their long-term cost projection.

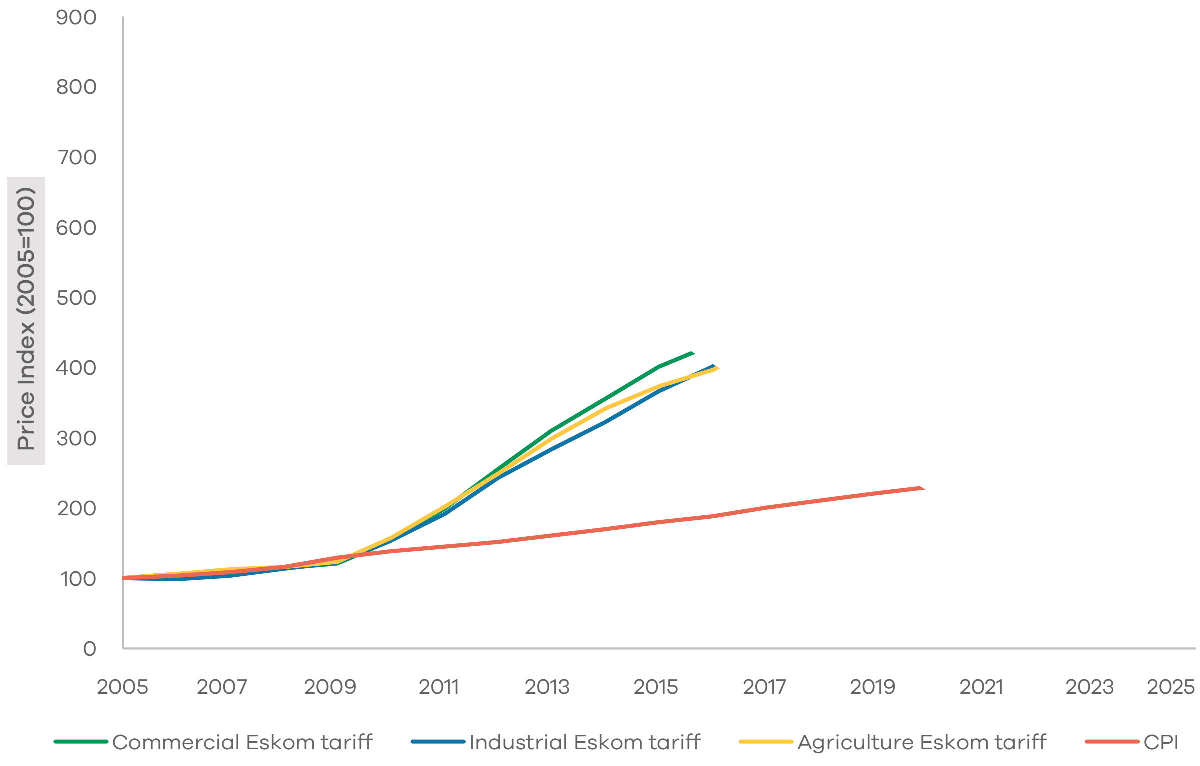


Figure 7: Price indices (2005=100) of Eskom average price increases for commercial, industrial, and agricultural customers
Source: Eskom, 2024b

In contrast to rising electricity tariffs, PV installation costs have generally trended downward. The levelised cost of electricity (LCOE), a measure of the equivalent cost of the electricity provided by a system over its lifespan, for embedded solar PV is compared against the average cost of electricity for commercial, industrial, and agricultural customers from Eskom in 2022/23 in Figure 8. Depending on the cost and level of utilisation of the embedded solar PV system and the tariff structure of the customer, the difference between Eskom's average cost per kWh and the LCOE of embedded solar PV translates to savings as high as 40 and 60 percent for electricity offset by embedded solar PV for energy users in the commercial, industrial, and agricultural sectors.

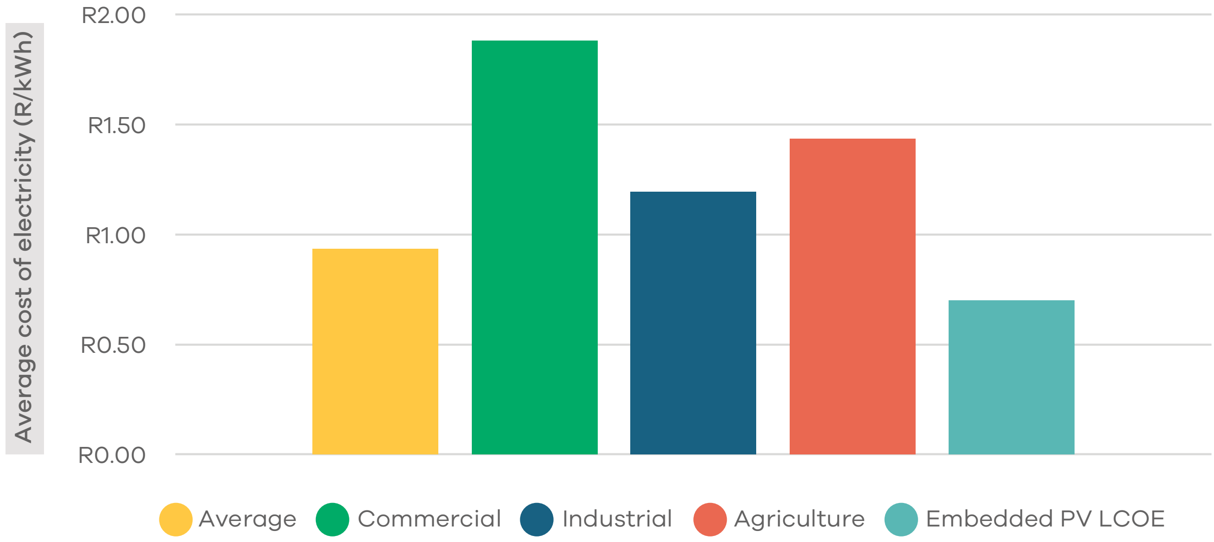


Figure 8: Average cost of electricity sold by Eskom (2022/23) for commercial, industrial, and agricultural customers versus LCOE for embedded solar PV

Source: GreenCape analysis, adapted from Eskom, 2024b

In the 2024/25 financial year, NERSA has approved average increases of 12.7% for Eskom direct customers and 10.8-16.1% for municipal customers (NERSA, 2024a; Eskom, 2024b). This shows a continuation of the trend of increases in electricity costs.

Changing tariff structures:

Apart from steep increases in electricity charges, there are other potential shifts in how customers are charged for their electricity and use of the grid that could impact the investment case for embedded solar PV. With more of their customer's electricity demands being met by embedded solar PV, distribution operators face:

- A loss of revenue as electricity is purchased.
- A steeper difference in demand from daytime to night time usage.

To mitigate the potential losses, distribution operators could move to increase the fixed charges for the use and maintenance of the grid. The decreased demand for daytime electricity due to embedded solar PV, coupled with the increase in daytime supply caused by more solar PV installations connecting to the grid, will likely slow the rate of increase of daytime tariffs but also drive night time charges to increase at a higher rate to counter the revenue losses from PV. This will also drive a shift towards time-of-use billing for electricity (Eskom, 2024b). Eskom has also submitted a proposed updated retail tariff plan, that includes changes to municipal customers' time-of-use periods and ratios as well as unbundling of the energy charge, for NERSA approval[10].

10 https://www.eskom.co.za/distribution/wp-content/uploads/2024/11/20241108-Summary-of-the-Eskom-Retail-Tariff-Plan.final_.pdf

4.1.2.2 Availability of attractive financing mechanisms

Along with the overall cost of PV decreasing substantially over the last decade, making outright purchase of a PV system more achievable, there are also alternative competitive options for financing PV systems. Most commercial banks offer some form of standalone product for solar PV finance as well as having them incorporated into existing products. Power purchase agreements along with debt financing and rent-to-own are the most prevalent financing mechanisms currently available. An overview of the most popular financing options for embedded solar PV installations is provided Table 6.

Table 6: Key decision-making considerations for the financing of embedded solar PV systems

Financing option	Benefits	Considerations
Outright purchase Buyer owns asset for entire lifetime.	Full ownership of the asset. Maximum cost-saving benefit from PV system.	Depending on the size of the system, the high upfront costs may be above what a business can afford. Owner takes responsibility for operating and maintaining system and system performance.
Debt finance Buyer borrows capital to install the system and owns the system once the lender has been paid back.	Allows for preservation of business's capital and liquidity Borrower retains ownership of their system.	Business must qualify for debt financing and have a track record of creditworthiness.
Rent-to-own, solar lease agreement Customer rents system and ownership is transferred to customer at the end of the lease agreement.	Gives the option of owning the system at the end of agreement Lessee not responsible for system performance risk .	Total lifetime costs will be more than debt finance and outright purchase of system.
Power purchase agreement (embedded) System is managed by a third party from whom the customer buys power at a predetermined cost.	Purchaser benefits from a cheaper tariff without upfront investment or responsibility for asset. Purchaser has accurate forecasting of electricity prices. Lessee not responsible for system performance risk.	PPA cost escalation rates may be higher than normal tariffs. Business must qualify for debt financing and have a track record of creditworthiness.

The most recent pricing benchmarks for embedded (rooftop) PV are provided in **Table 7**. It illustrates the impact of economies of scale on the costs of embedded solar PV systems as well as the typical ranges for the various financing mechanisms for embedded solar PV that are currently available. Price multipliers for alternative configurations for embedded solar PV systems are also presented.

Table 7: Benchmarks for embedded solar PV 2024/25
Source: GreenCape analysis

Procurement option	<100 kWp		100 kWp -500 kWp	500 kWp -1MWp	>1 MWp
Outright purchase R/kW installed capacity	R 13.50 – R 16.50		R 12 – R 15	R 11.50 – R 14	R 11 – R 13.50
Debt finance	Above amortised plus risk-dependent interest, typically below prime. See [GreenCape's Green Finance webpage[11]]				
Lease-to-own (10 years) per month excl. annual escalation	R 7 000 – R 30 000				
Power purchase agreement	Cost per kWh up to 30% cheaper per kWh than existing Eskom/municipal tariff. CPI-related escalation rate of PPA tariff (+-7%) per annum for customers prioritising energy cost savings or price stability.				
Cost multiplier for different PV configurations	Rooftop	Rooftop with asbestos replacement	Ground-mount	Floating	Carport
	1.00	1.30 – 1.50	1.10 – 1.20	1.50 – 1.75	1.25 – 2.00

South Africa's well-developed energy finance ecosystem enables a broader market to access solar PV, offering businesses a variety of financing options that cater to their specific needs. This improved access to procuring (electricity from) embedded solar PV solutions is expected to drive significant growth in the market.

4.1.2.3 Enabling regulations by distribution utilities

The distribution networks in the Western Cape are operated and regulated by municipalities and Eskom with oversight from NERSA. Enabling distribution utility regulations that apply to the majority of customers on municipal and Eskom distribution networks also improves the investment case for embedded solar PV in the agricultural and C&I sectors. Of the 30 municipalities in the Western Cape, 19 have SSEG feed-in tariffs in place that range from around R 0.48 to R 1.69 per kWh, depending on the municipality and the time of generation. A map of the Western Cape and the available feed-in tariffs is provided in **Figure 9**. Although the feed-in tariffs offered by distributors are still markedly less than the value per unit of electricity offset from the grid by using embedded generation, they still have a significant impact on the investment case for embedded generation. The City of Cape Town has also enabled embedded generators to earn additional revenue from their exported power, instead of only providing a credit to offset a customers electrical bill, the City's the Cash for Power programme pays embedded generators out for power exported to the grid once their entire municipal account is offset by the credits.

11 For further information, see GreenCape's Green Finance webpage at https://greencape.co.za/sector/green-finance/

Feed-in tariffs allow embedded generators to sell excess power. Furthermore, high and medium-voltage customers that are located in Eskom distribution areas have the option to make use of energy banking or offset tariffs offered by Eskom. These incentives allow for higher utilisation rates of the PV installation and are especially relevant for agricultural and industrial users who experience fluctuations in energy demand depending on the season or day of the week and are typically connected to Eskom.

Western Cape municipalities like Swartland, George and the City of Cape Town allow wheeling within their distribution areas, with George and Cape Town both in the process of conducting pilot projects for wheeling. Langeberg municipality is also in the process of allowing wheeling, with its proposed wheeling framework being approved by Council in October, 2024. The opening up the market to allow agricultural and C&I generators located in municipal distribution areas to wheel excess generation to other offtakers, as in the case of these four municipalities, strengthens the investment case for embedded generation systems.

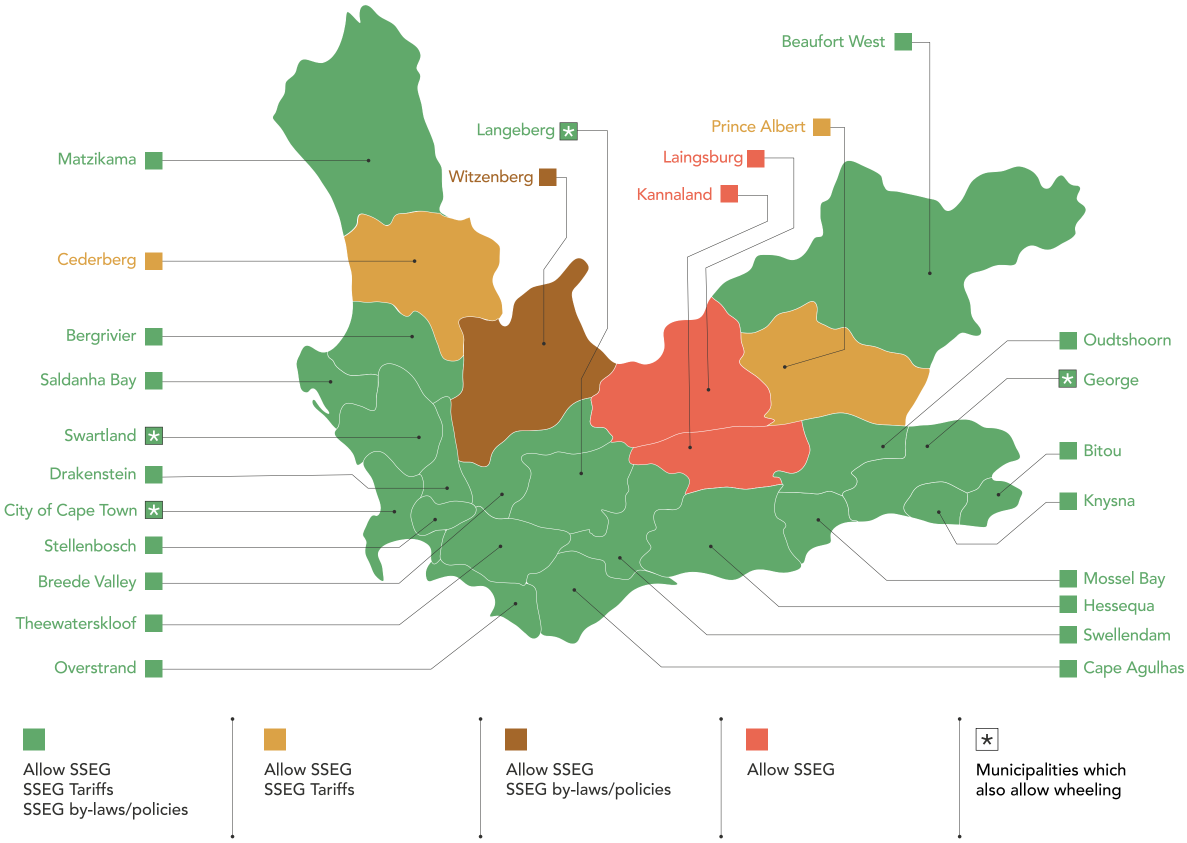


Figure 9: Map of Western Cape municipalities with feed-in tariffs for embedded generation
Source: GreenCape municipal engagements

4.1.2.4 Increased global pressure for carbon emissions reductions

Amidst a global push for reducing carbon emissions, local businesses have been subject to pressures to decarbonise through international commitments and regulations, as well as supply chain due diligence and environmental, social, and governance (ESG) reporting requirements. In order to meet the demands of trade partners, businesses embedded in these global supply chains have been looking to procure embedded generation systems and typically solar PV to reduce carbon emissions related to their energy usage.

Key trade partners of the Western Cape, such as the European Union (and its member states), the United Kingdom, the United States, and China, have regulations in place that require businesses to adhere to stricter sustainability standards. The EU's Corporate Sustainability Reporting Directive (CSRD), Corporate Sustainability Due Diligence Directive (CS3D), and the Carbon Border Adjustment Mechanism (CBAM) all place significant emphasis on the environmental impacts across entire value chains, including upstream and downstream carbon emissions, pushing businesses to lower their carbon footprints to maintain market access.

At the time of writing, the United States has similar supply chain reporting policies in place that affect local exporters, such as the Securities and Exchange Commission's (SEC) climate disclosure rules, which require public companies to report climate-related risks and demonstrate mitigation measures, thereby driving U.S.-based companies and their global suppliers to adopt decarbonisation strategies. Similarly, China's new corporate sustainability reporting guidelines, implemented in 2024, set the stage for mandatory sustainability disclosures for public companies, reinforcing the global trend toward environmental accountability (Wesgro, 2024).

These regulations collectively heighten the need for companies with ESG obligations and exporters in the Western Cape to implement renewable energy solutions like solar PV. By transitioning to solar PV, businesses can reduce emissions related to energy consumption, thereby complying with international sustainability requirements, maintaining their access to these key global markets, and benefiting from cost savings and energy security.

4.1.3 Barriers

With the rapid uptake of embedded solar PV, challenges evolve with regard to pressure on distribution network operators to manage the rollout on their infrastructure and to carry out the necessary vetting and registration processes in a timely fashion. A shortage of the required workforce to support the growing market can drive up the cost of investing in embedded solar PV.

4.1.3.1 Challenges with distribution infrastructure

As the rollout of embedded generation continues, it is anticipated that the challenges faced by distribution operators will continue to evolve, with issues associated with managing the grid in areas with a high level of embedded generation penetration becoming increasingly prevalent. One of the key challenges facing market growth is the rapid uptake of embedded generation as well as battery storage, which is outpacing the ability to adapt legislation and distribution infrastructure. While governing frameworks such as NRS 097-2-1[12] play an important role in maintaining safety and stability in the grid, they are not designed to maximise embedded generation within distribution grids, which is becoming a growing requirement.. Furthermore, the current regulations require conservative calculations of maximum export capacity by summing the inverter capacities of both PV and battery systems, even though, in practice, these systems are rarely designed to export at full capacity simultaneously. This can limit the size of installations unnecessarily.

The distribution grid, managed by municipalities, faces issues with aging infrastructure that can create bottlenecks and delays in connecting new renewable projects. Aging infrastructure can lead to unreliable power supply and inefficiencies, and inconsistent governance and tariffs, can complicate renewable energy integration and increase costs thus affecting project viability. Businesses may experience disruptions or higher costs, but these challenges also present opportunities to contribute to grid modernisation, enhancing the long-term reliability and profitability of renewable investments. The decline in investment in maintaining municipal assets from 2009 to 2019 for all nine provinces is depicted in Figure 10.

12 NRS 097-2-1: Grid Interconnection of Embedded Generation – Part 2 Small-scale embedded generation – Section 1: Utility interface

The needs for maintenance, refurbishment, and strengthening backlogs in the distribution network are significant, with estimated costs reaching R68.1 billion as of 2014. The ability of distribution networks to accommodate embedded generation largely depends on the speed and effectiveness of these distribution grid improvements.

In the short term, the South African Government has proposed solutions such as bulk energy storage to manage capacity constraints. However, long-term success hinges on constructing new transmission and distribution infrastructure for effective integration of renewable energy sources. Collaboration between industry and the public sector is essential to expedite these developments and explore funding models to support the necessary grid upgrades.

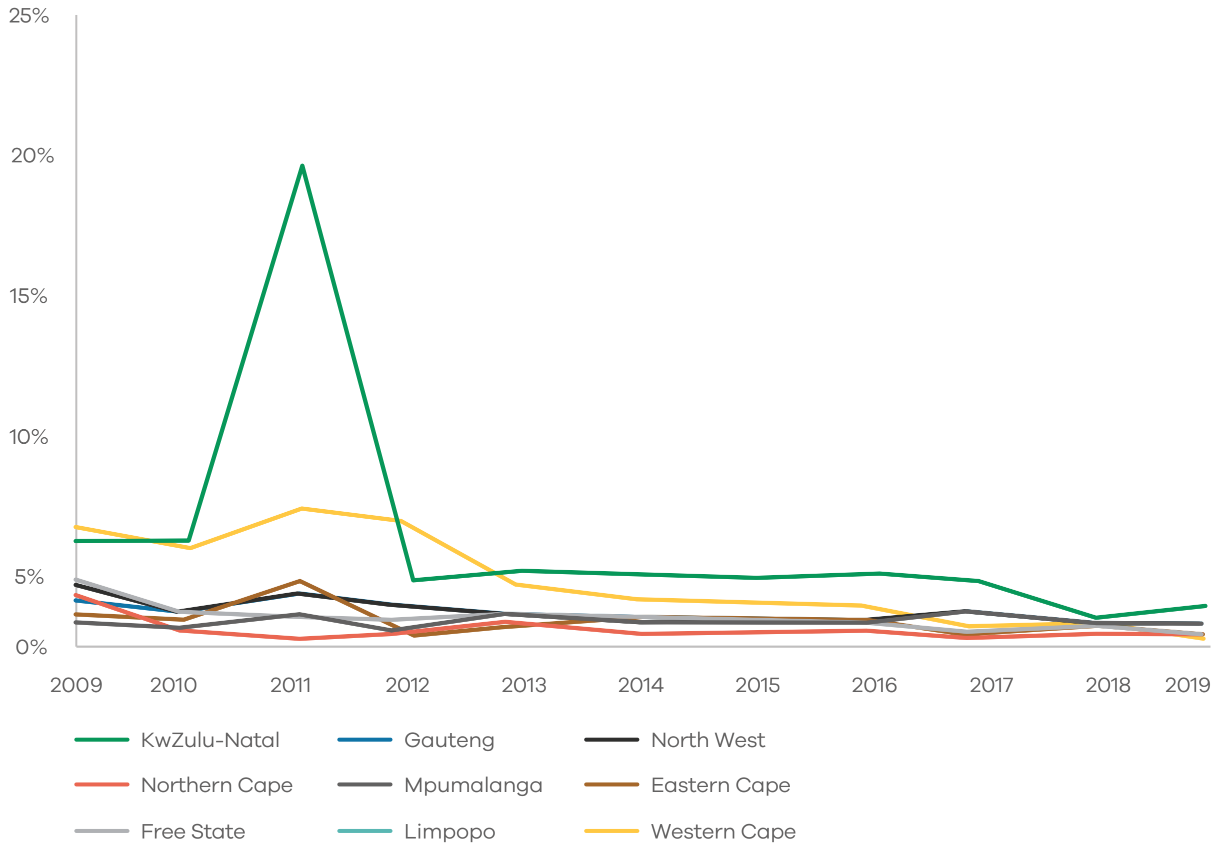


Figure 10: Municipal maintenance and repairs as a ratio of assets
Source: Codera Analytics; National Treasury, 2024

4.1.3.2 Limits on administrative capacity of municipalities

The speed and magnitude at which embedded solar PV has been rolled out in the Western Cape has put pressure on distribution operators (e.g. municipalities, Eskom) to manage the effects of these systems on their grids. Rigorous checks are required to ensure that systems installed meet regulatory requirements including those associated with grid integration and safety. Furthermore, embedded generators who wish to feed excess power to the grid require the necessary metering infrastructure to be in place. This vetting, registration, and approval of new PV installations places an additional administrative burden on distribution operators that face resource constraints to carry out this work with a backlog in processing of applications of several months in some cases. Municipalities have made significant strides to address this backlog, with 17 municipalities in the Western Cape having implemented online registration platforms. These streamlined registration processes, however, are not typically primed for larger installations and as such, some delays in carrying out the proper registration of agricultural and C&I-scale systems remain.

Customers who wish to export power or wheel between dispersed sites within a municipal distribution area face delays and uncertainties and administrative hurdles around the applicable tariffs. Similarly, the nature of the registration process and regulatory framework for embedded generation varies between the different municipalities. For project developers and installers that operate throughout the province, these discrepancies add delay and uncertainties to projects.

4.1.3.3 Skills availability

The rapid growth of the embedded solar PV industry in the Western Cape has led to workforce shortages for key occupations in the sector. This workforce shortage forms part of a global issue that exists with labour shortages in the renewable energy sector. Table 8 provides a mapping of the most in-demand occupations in the embedded solar PV sector in the Western Cape based on stakeholder consultation. The distribution of these occupations throughout the lifecycle of a solar PV installation shows that the majority of the shortages exist in the installation and EPC stages. The critical occupations required span across the spectrum of workforce segments but are concentrated in technical areas, highlighting the importance of specialised training and skill development. The relatively recent growth in the market also translates to a shortage of experienced candidates These shortages impede the growth of the PV market as they limit the number of projects that can be constructed in a timely manner and also drive up costs of installing PV systems. A shortage of workers with the correct qualifications to perform the required quality certification functions when installing an embedded solar PB system can also lead to non-compliant or poorer quality installations.

Table 8: Most in-demand occupations in embedded solar PV value chain
Source: GreenCape analysis

Workforce segment/ Project stage	Project development stage	Installation, engineering, procurement, and construction stage	Operations and maintenance stage
White collar	Project developer	Project manager	Asset manager
Professional (highly skilled)	PV designer/ Design engineer Grid connection engineer	PV designer Structural engineer, Medium/low voltage electrical engineer Project engineer	
Blue collar (skilled)		Solar installer (electrician) Millwright Battery technician	Battery technician
Blue collar (semi-skilled)		PV mounter	
Blue collar (unskilled)		Solar site worker Civil worker	

Work is being done to meet these skill demands where industry and government have partnered. There are a range of initiatives being driven by government and government agencies (notably the Department of Higher Education and Training (DHET) and the Energy and Water Sector and Training Authority (EWSETA)) and industry associations (notably the Solar Photovoltaic Industry Association (SAPVIA) and the Electrical Contracting Association of South Africa (ECASA)) as well as initiatives multi-party such as the development of the PowerUp Skills Facilitation Platform originating out of the South African Renewable Energy Masterplan (SAREM) to accelerate the development of the skills required by the renewable energy industry. However, with the current pace of growth in the embedded solar PV sector and the complexity of required skills, these efforts face challenges in scaling quickly enough to address the immediate shortages. The development of effective training programs, investment in educational infrastructure, and attraction of skilled labour remain crucial. Without accelerated and coordinated action, the sector risks experiencing prolonged delays and increased costs, which could hinder its ability to contribute to renewable energy goals and economic growth in the region.

4.2. Opportunity 2: Large-scale renewable energy

Large-scale wind and solar PV projects are standalone facilities that feed in to the electricity grid and do not serve a local load. These projects are either publicly procured through the REIPPPP or via (limited) municipal procurement, adding to the public sector energy supply. Alternatively, they are privately procured through power purchase agreements, using the transmission or distribution grid to transfer electricity from the generator to the buyer. The primary technologies for large-scale renewable energy projects in South Africa are solar PV and onshore wind.

4.2.1 Investment opportunity

With some of the country's best wind and solar resources in the Western Cape, large-scale renewable energy projects continue to be developed for both public and private buyers, though limited grid capacity remains a significant barrier. The province also hosts the headquarters of many large-scale renewable energy developers attributable, among others, to the geographical location and efforts by regional and local governments to increase the ease of doing business. Eskom's latest Generation Capacity Assessment (Eskom, 2023), reported effectively zero available connection capacity in the Western Cape supply area for large-scale projects (as well as in the Hydra Central area, which partially covers the province). Despite these constraints, there is potential for more capacity through curtailment[13] and planned transmission upgrades. The large-scale renewable energy sector remains active, with new projects continuing to be developed and rolled out as they secure grid capacity. The current landscape of large-scale projects in the Western Cape is provided in **Figure 9**[14].

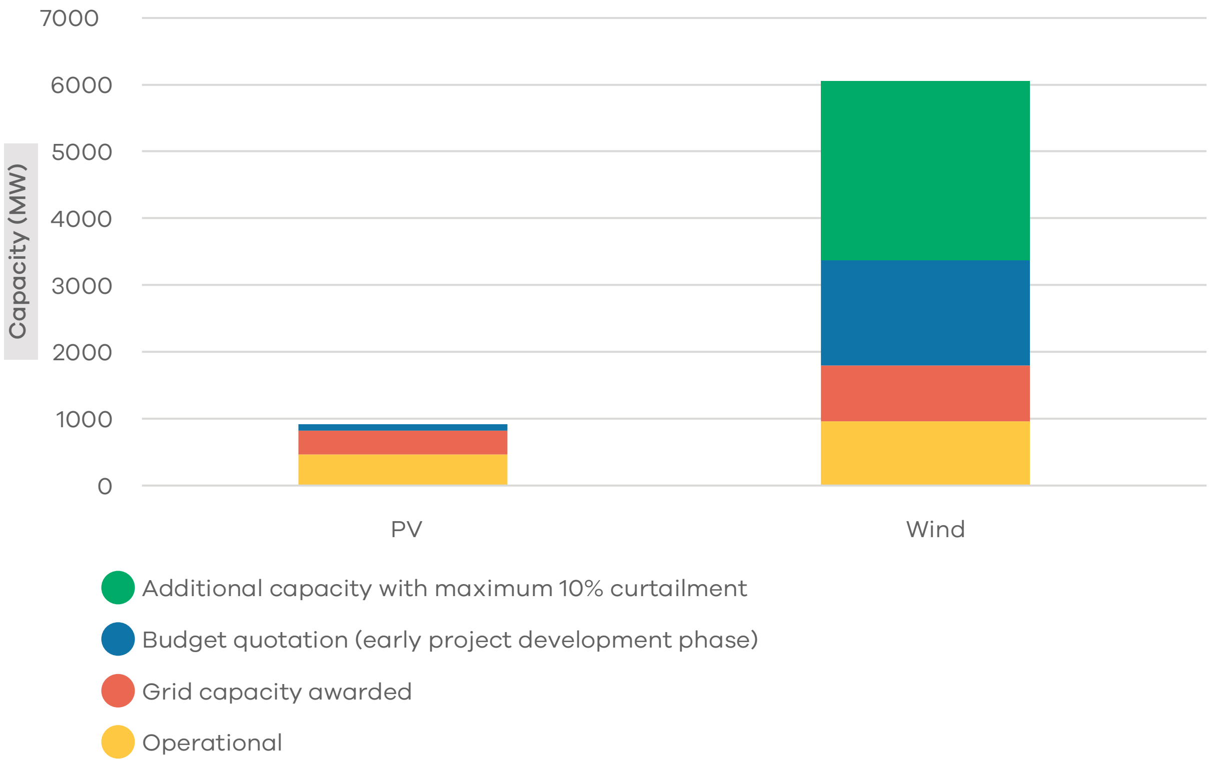


Figure 11: Current large-scale renewable energy project landscape in the Western Cape
Data source: Eskom, 2023

13 Curtailment of renewable energy to manage grid congestion refers to the practice of limiting the output of renewable energy of certain generators in times when generation exceeds the amount of power that can be evacuated at a given time.
14 Additional capacity made available by curtailment allocated to wind projects in line with statements made in Eskom's Addendum to the Generation Connection Capacity Assessment, 2025 (Eskom, 2023)

According to Eskom's latest grid survey, the Western Cape currently has 465 MW of large-scale PV and 958 MW of wind power installed. In the near term, 353 MW of solar and 840 MW of wind PV projects have secured grid capacity and are expected to be completed within six years. This represents a current market size of R21 billion, with an additional R18 billion in upcoming large-scale projects. If a proposed 10% curtailment cap is introduced, it could unlock an additional 2 680 MW in wind projects, translating to R45 billion in potential investment[15].

4.2.2 Drivers

Investment in large-scale renewable energy in the Western Cape is appealing due to several key factors: The improved cost competitiveness of renewable technologies, a supportive environment for wheeling and energy trading, carbon reduction targets for large power users, and plans to expand grid capacity. Together, these drivers position the province as a favourable destination for renewable energy projects.

4.2.2.1 Improved cost competitiveness of renewable energy technology

In contrast with rising electricity costs charged by Eskom and distributors, the cost of renewables has trended downwards for over a decade. The ability for large-scale wind and solar PV generators to offer energy at costs lower than that of South Africa's coal-dominated grid is a major driver for the growth of the market. The levelised costs of large-scale wind and solar PV are compared with levelised costs of coal-based generation in **Figure 10**. Over the past 14 years, the global average[16] LCOE for utility-scale solar PV and South African average LCOE for onshore wind have dropped by approximately 67% and 91%, respectively. In comparison, the cost of coal power in South Africa has increased by 61% in the same period. This increase is also apparent in the escalating costs of purchasing electricity from Eskom, illustrated in (**Figure 8**). As prices of utility-scale renewables have fallen, cheaper PPAs become more achievable, giving renewable energy projects the potential to offer cheaper electricity than the grid's coal-dominated energy mix. Furthermore, as opposed to the large tariff increases associated with purchasing from Eskom, PPAs offer longer term price certainty and lower tariff escalation rates. These factors make the procurement of renewable energy attractive to large and medium power users, driving demand in the market.

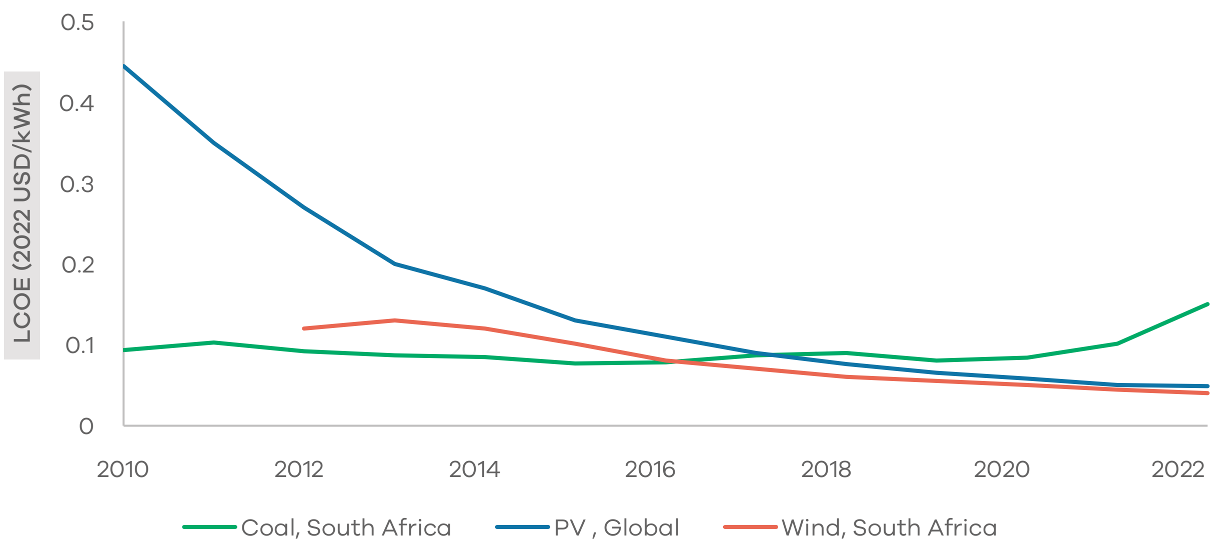


Figure 12: Levelised cost of energy for coal (South Africa) in comparison with LCOEs for utility-scale wind (South Africa) and solar PV (global average)

Source: IRENA, 2023

15 Market size estimates based on R17/Wp for large-scale wind and R12.25 for large-scale solar PV
16 Due to data availability constraints, the global average was used for large-scale solar PV LCOE

4.2.2.2 Enabling environment for wheeling (virtual), energy trading

Wheeling refers to the use of third-party transmission and distribution networks to deliver power from generators to offtakers, allowing independent power producers to sell directly to customers while paying for the use of the electricity grid through use-of-system charges. By signing PPAs with renewable energy generators, or energy traders, larger power users are enabled to reduce their carbon footprint, achieve greater price certainty for their energy, and typically decrease energy costs

Typically, wheeling has been carried out from an Eskom-connected power producer to an Eskom-connected offtaker where Eskom is paid use-of service charges and the offtaker pays the generator and the utility, and is then reimbursed by the utility. The accounting process becomes slightly more complex when the offtaker is a municipal customer as the payment to the utility must either run through the municipality to Eskom, or virtual wheeling would need to be used instead of traditional wheeling.

Virtual wheeling offers a mechanism for low and medium voltage customers to procure wheeled energy regardless of their distribution network operator, and without having to pay both the generator and utility. Eskom is in the process of launching its virtual wheeling platform, having signed its first virtual wheeling agreement with Vodacom in August 2023. Municipalities in the Western Cape are also making strides to facilitate wheeling in their distribution networks. The differences in the payment flows of virtual versus traditional wheeling are illustrated in Figure 13. The status of wheeling in municipalities in the Western Cape is provided in Figure 9.

Table 9: NERSA-approved energy traders as of November, 2024

NERSA-APPROVED TRADER	WEBSITE
Africa GreenCo	https://africagreenco.com/
Apollo Africa	https://www.apolloafrica.co.za/
Discovery Green	https://www.discoverygreen.co.za/portal/dgr/home
Energy Exchange of Southern Africa	https://www.energyexchangesa.com/
Enpower	https://enpowertrading.co.za/
Envusa	https://www.envusa.com/
Etana	https://www.etana.energy/
NOA	https://noagroup.africa/
PowerX	https://powerx.energy/

Another major shift in the market is taking place as the process of unbundling Eskom continues. The NTCSA officially started trading in mid-2024 after receiving its trading license from NERSA in 2023. Energy trading is a NERSA-regulated function. To become an energy trader, NERSA needs to issue a trading licence to allow an entity to buy and sell electricity. Traders are set up to purchase energy from independent power producers and on-sell that energy to customers. Traders can aggregate multiple generation sources and supply multiple customers with their energy needs; they can combine multiple customers' energy needs to match multiple generation sources and, in doing so, create more bankable generation projects. The recent approval of several trading licences for new energy traders by NERSA also indicates the market is shifting to accommodate smaller energy users' demand for renewable energy. These smaller energy users can now also benefit from economies of scale due to the service provided by energy aggregators and traders. Table 8 provides a list of 9 NERSA-approved energy traders as of November, 2024.

Municipal procurement of large-scale renewable energy in the Western Cape Swartland Municipality, Darling Green utility municipal PPA case study

Municipal procurement regulations typically make it difficult for municipalities to procure renewable energy due to the limits put on contract durations typically being incompatible with most PPA structures. An example of where a municipality has found a way to work within the bounds of the MFMA[17] to procure renewable power from an IPP is illustrated by the Swartland Municipality signing a three-year PPA with Darling Green Utility. This agreement allows for the municipality to purchase excess power generated by a 1 MW solar plant that will ultimately form part of a larger solar farm, built to power the Darling Green Country Estate that is currently under construction.

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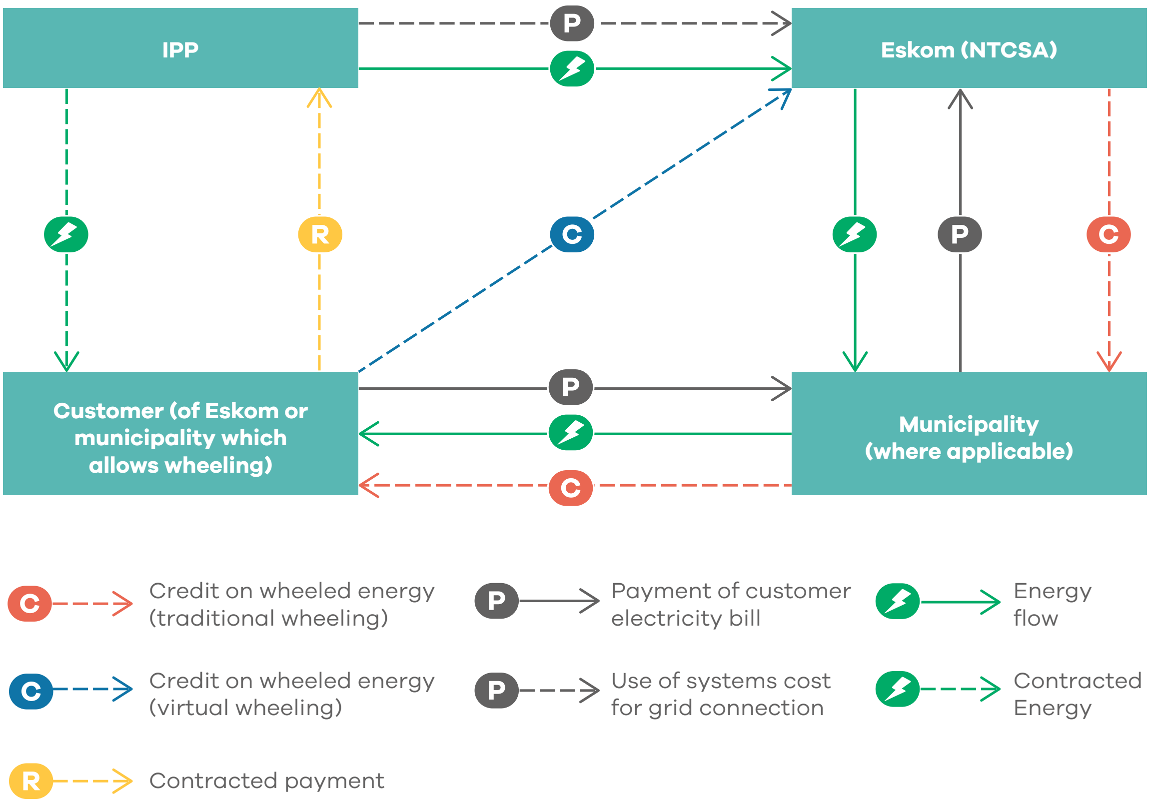

Figure 13: Possible configurations of wheeling agreements
Adapted from: Eskom, 2023

Cape Town solar PV project

In October 2024, the City of Cape Town initiated the construction of the first city-owned and operated utility-scale solar PV plant in South Africa. The 7 MW facility, located in Atlantis, approximately 40 km from the city centre, represents a R200 million investment. The Lesedi Technoserve consortium was awarded the EPC contract, and the project is scheduled for completion by the end of 2025. The City has also issued a tender for a 5 MW battery energy storage system to be co-located with the solar PV plant to provide energy storage capacity. This investment from the City provides another example of how municipalities can make efforts to reduce their dependence on the national grid and to meet their sustainability goals. Along with this project, several other municipalities in the Western Cape have published tenders for

17 The MFMA dictates that a more extensive procurement process with council approval is required for contracts longer than three years.

4.2.2.3 Carbon emissions reduction targets for large power users

Large companies are increasingly directing efforts towards decarbonisation, driven by both internal and external targets and policies aimed at reducing Carbon emissions and their environmental impact as a whole. Energy-intensive businesses are thus actively seeking to procure renewable energy. Failure to decarbonise their activities can lead to higher costs, diminished competitiveness, and restricted access to certain markets that prioritise low carbon products and broader sustainability.

One of the most significant policy tools that addresses the carbon emissions of exporters is the European Union's Carbon Border Adjustment Mechanism (CBAM). It imposes duties on carbon-intensive imports, initially covering the product categories of cement, iron and steel, aluminium, fertilisers, electricity, and hydrogen (European Commission: Taxation and Customs Union, 2024). Through this policy tool, local companies that export to the European Union are encouraged to reduce carbon emissions to avoid tariffs. Similarly, the United Kingdom has announced its own carbon border adjustment mechanism, set to take effect in 2027 (HMRC, 2024), further adding pressure on industries reliant on exports. This opens the market for on-site projects and PPAs enabled through wheeling.

Similarly, on a local front, companies listed on the Johannesburg Stock Exchange (JSE) are subject to certain ESG reporting standards (JSE, 2022). This transparency, combined with heightened scrutiny from investors and stakeholders, is pushing companies to demonstrate their commitment to ESG principles by pursuing renewable energy procurement.

In response to both local and global regulatory environments, South African businesses are thus aligning their strategies with climate action goals. The recently enacted Climate Change Act (2024) creates a regulatory framework for a low-Carbon, climate-resilient economy by establishing sectoral emissions targets (SETs), mandating greenhouse gas reporting and climate risk disclosures, and promoting a just transition. Although the Act is not yet operational, it signals a significant shift in South Africa's climate policy, which companies must prepare for by adjusting operations and investing in sustainable practices.

Section 12U of the Income Tax Act 58 of 1962 provides capital allowances for tax relief on expenses incurred for roads and fencing at renewable energy facilities that generate more than 5 MW of electricity from sources such as wind, solar, hydropower, and biomass. This allowance helps lower the initial infrastructure costs of large renewable projects, thereby enhancing project viability and cost-effectiveness.

In parallel, global frameworks such as the Task Force on Climate-related Financial Disclosures (TCFD) are prompting companies to disclose their climate-related risks, including carbon emissions (HM Treasury, 2024). Many international investors demand compliance with TCFD guidelines, putting additional pressure on South African companies with global investors or trade relationships to reduce carbon emissions through renewable energy investments. The shift to renewable energy is thus becoming essential not only for regulatory compliance, but also to maintain access to capital and remain competitive in international markets.

4.2.2.4 Plans to increase grid capacity

Eskom's Generation Connection Capacity Assessment of 2025 addendum announced that 2 680 MW of grid capacity could be opened up in the Western Cape for wind generation should existing projects accept a reasonable share of 10% maximum curtailment (as illustrated in Figure 11). Curtailment of renewable energy refers to the practice of limiting the output of renewable energy certain generators in times when generation exceeds the amount of power that can be evacuated at a given time. This is a mechanism for mitigating congestion in electrical grids allows for more generation to be connected to the grid and is readily used by grid operators globally.

In May 2024, Eskom submitted an application to NERSA requesting approval for curtailment to be treated as a constrained generation ancillary service. This can be a mechanism to alleviate a large degree of the grid capacity constraints in the short-term in conjunction with other grid strengthening efforts that are being pursued.

There are plans to upgrade transmission infrastructure that will further expand the capacity that can be connected to the grid. Eskom's latest Transmission Development Plan (2025-2034) laid out plans to connect 56 GW of new generation to the grid nationally in the next 10 years, with a major focus of those efforts to increase grid connection capacity in the Cape regions. It has also prioritised specific projects that can provide 10 GW of capacity in the next five years. The planned transmission network upgrades along with the proposed implementation of curtailment both signal that efforts are being made to alleviate grid constraints that will be of benefit for renewable energy project development in the Western Cape.

4.2.3 Barriers

The growth of large-scale renewable energy in the province faces challenges primarily due to limited grid capacity and difficulties in reaching potential customers or offtakers within municipal distribution networks. Uncertainty around the pace of grid upgrades, new policies, and the national strategy for renewable energy rollout adds a number of additional complications to the growth of the market.

4.2.3.1 Grid constraints

South Africa's grid was initially designed to host the bulk of the generation in the Northeast part of the country, not in the coastal provinces such as the Western Cape. As indicated, the high demand for grid connection in the province has caused the grid to become fully-subscribed, with many new projects being denied grid connection as a result. As such, the upgrading of the transmission network remains a key focus with the latest iteration of Eskom's Transmission Development Plan (2024) citing the need for over R200 billion to upgrade its infrastructure and to build the 14 000 km of transmission lines required, nationally. With historic building rates of approximately 300 km per year (NTCSA, 2023), significant advancements in Eskom's (now the new NTCSA's) processes are required should the required upgrades be made within their planned timeframes. This barrier to constructing large-scale renewable projects in the province has led developers to look to provinces that have grid capacity for new projects, rather than facing the uncertainty associated with how and when the grid capacity in the Western Cape will be increased.

4.2.3.2 Policy uncertainty

Although there are efforts being undertaken to strengthen the grid in the region, uncertainties still exist regarding the exact nature of these changes and when they are anticipated to come into effect. REIPPPP generators will be compensated for their curtailed power in the form of deemed energy payments, as was stipulated in their contracts. However, for private-offtake generators, Eskom proposes that all customers would be responsible for paying for curtailment as part of the ancillary services charges. In Eskom's proposal, both offtaker and generator will not be directly affected by curtailment as the lost revenue would be recovered through the ancillary service charge. This curtailment proposal is still in the stakeholder engagement phase with NERSA and the exact mechanisms for curtailment have not yet been determined (NERSA, 2024b). This adds uncertainty and risk to new projects being developed in the Western Cape.

Additionally, the Interim Grid Capacity Allocation Rules (IGCAR) also pose uncertainties for projects as it has moved grid allocation from a "first-come, first-served" approach, to give preference to project that are ready to proceed with project construction. IPPs will also be held liable to any significant deviations from the project plan presented to Eskom. This was in an effort to prevent projects with longer lead times from occupying grid capacity that could rather be given to projects that would be operational sooner. This caused issues for project developers as becoming "shovel-ready" often requires some guarantee of grid access for the project to move forward with development, and the new rules would require greater resource commitments for projects that may not receive their required capacity. There have also been concerns with REIPPPP projects receiving preferential grid access at the expense of other generators.

In terms of a wider, national strategy for the procurement of renewables, the latest iteration of the Integrated Resource Plan had a draft released for public comment in November 2024, after the previous draft, IRP 2023, had to be revised. The draft released in 2023 had significant differences in terms of the planned rollout of wind and solar PV compared to the preceding IRP 2019. Whereas the 2019 IRP (DMRE 2019) featured 17.7 GW and 8.2GW of wind and solar PV, respectively, IRP 2023 (DMRE 2023) laid out 7.9GW and 5.9GW (DMRE, 2023; DMRE, 2019). Furthermore, IRP 2023 itself was subject to a significant amount of scrutiny due to uncertainties around the validity of the assumptions on which it was based as well as the lack of transparency around the modelling. As of writing this report, uncertainties remain on the final IRP 2024, however there are indications that renewable energy features more prominently in the planned capacity it lays out. Due to being the foundation for the strategy of public procurement of renewable energy, as well informing Eskom's Transmission Development Plan, the national government's strategy as embodied in the IRP needs to be clear and stable to enable investment in large-scale public procurement of renewable energy.

4.2.3.3 Municipal readiness

A large proportion of energy users in the province are located in municipal distribution areas. When municipalities are unable to facilitate wheeling transactions, either due to a lack of wheeling frameworks or internal capacity, the customer base of offtakers for large-scale renewable energy projects becomes limited. Municipalities are often prevented from allowing wheeling in their networks either due to costs involved with amending their electricity supply agreements, or due to a lack of internal resources and processes to facilitate the wheeling transaction.

In the Western Cape, George and the City of Cape Town currently allow wheeling in their distribution networks, with both in the process of piloting wheeling. Swartland Municipality has a wheeling framework in place. The rest of the municipalities in the Western Cape have yet to implement wheeling or publish their frameworks to allow wheeling to their customers. Implementing wheeling through a municipality's distribution network requires that municipalities have the internal processes, structures, and resources to accommodate this new type of transaction. This involves modified approaches to billing and metering the customers or generators doing wheeling in their networks. There are additional skills and resources required to facilitate this. This becomes a challenge for municipalities that are still becoming familiar with wheeling transactions and particularly so for smaller municipalities that typically are resource-constrained

The advent of virtual wheeling (outlined in Section 4.2.2.2) and the successful completion of the current wheeling pilot projects are both anticipated to open up the market to new offtakers.

4.3. Opportunity 3: Behind-the-meter Lithium-ion battery energy storage

BTM Li-ion battery storage, installed on-site and integrated with the premise's electrical system, helps users maintain energy quality and security. It also offers the potential for additional savings and revenue through value-stacking. Li-ion batteries outperform other backup power technologies due to their low operating costs, high efficiency, and longer lifespan. For commercial, industrial, and agricultural users, adding batteries to existing PV systems increases the level of utilisation of the installation. The business case for BTM storage in large-scale applications is strengthened by shifting tariff structures and rising energy costs, as it helps reduce expenses related to time-of-use and peak consumption tariffs.

4.3.1 Investment opportunity

Li-ion batteries have become the most common form of BTM storage due to their reliable backup power capabilities and numerous value-stacking opportunities. Their adoption has been driven by the decreasing cost of technology, along with improved performance, higher energy efficiency, and longer lifespan compared to alternatives like lead-acid batteries. Li-ion batteries also offer lower operating costs, require less maintenance, and are more cost-effective over time. Additionally, batteries can be used for multiple purposes, such as reducing peak demand charges and enabling time-of-use savings, making them highly attractive in regions with rising energy costs.

This combination of factors creates a significant business and investment opportunities in the BTM storage value chain in the Western Cape, particularly in the areas of EPC and project development. These players are likely to install BTM storage as part of or alongside embedded PV projects for commercial, industrial, and agricultural applications.

The market for BTM storage is closely linked to the growth of embedded PV, and it is expected to develop similarly. Currently, for large-scale installations, the market size for BTM Li-ion storage in the Western Cape is approximately R750 million, with 0.36 MWh of storage installed per MW of embedded PV[18]. This market is projected to grow to around R2.3 billion by 2030, with installed capacities increasing from about 170 MWh in 2024 to 540 MWh in 2030. Investment opportunities in this market are expected to materialise over the medium term as storage costs continue to decrease and the market stabilises following the demand surge driven by loadshedding.

4.3.2 Drivers

The drivers for investment opportunities in the Li-ion BTM market in the Western Cape are based on the improving business case for implementing the technology. Value stacking opportunities, as well as improved energy security and quality that the technology can provide, are encouraging commercial, industrial, and agricultural power users to adopt Li-ion batteries as BTM storage solutions.

18 GreenCape market analysis

4.3.2.1 Improved business case of battery energy storage

Since 2013, the global average cost of Li-ion batteries has decreased by 82% (Statista, 2024). When this decrease is contrasted with escalating electricity costs (which are illustrated in Figure 8), and more widespread time-of-use tariffs, BTM storage solutions emerge as a potential tool to mitigate against these rising costs.

Li-ion batteries have become the preferred technology for backup power for many businesses due to their long lifespans and efficient operation. A comparison of key characteristics of the most prevalent backup power technologies is provided in Table 8, with Li-ion batteries comparing favourably from a performance and a levelised cost of storage (LCOS) perspective.

Beyond serving as backup power during outages, BTM storage offers the opportunity to charge batteries using cheaper energy sources, such as excess solar PV or off-peak power, to offset higher electricity costs. This opens up potential savings and revenue opportunities. Batteries can also be discharged during peak demand times to avoid extra costs from demand charges. With distribution utilities likely using time-of-use tariffs to offset potential revenue losses due to the rise in embedded PV, the investment case for BTM storage becomes increasingly attractive as a way to reduce energy expenses. The various mechanisms for leveraging BTM storage installations to provide benefits for commercial, industrial, and agricultural power users are provided in Table 10.

Table 10: Comparison of leading backup power technologies for businesses
Source: GreenCape Analysis

TECHNOLOGY	ADVANTAGES	DISADVANTAGES	INVESTMENT COST (R/KWH CAPACITY)	LCOS (R/ KWH UNITS)
Li-ion batteries	High efficiency. High energy density. Improving technology in terms of performance and cost. 8–12-year lifespan. Fast recharge time relative to other battery storage technologies.	The global lithium supply chain is constrained. Safety –thermal runaway. Impact and cost of disposal.	6 000 – 10 000	3.50 – 6.50
Advanced lead acid batteries	Superior cycle life and depth of discharge compared to conventional lead acid. Function well at partial state of charge. Low upfront cost compared to Li-ion.	Impact and cost of disposal. Can be hard to find reliable quality. Short lifespan (2–3 years).	2 000 – 3 000	5.00 – 6.50
Diesel/petrol generators	Dispatchable. Portable options available.	Unstable petrol and diesel prices. Chance of breakdown. Requirement of maintenance. May have carbon tax implications.	2 000 – 3 500	6.50 – 11.00

Table 11: Breakdown of value stacking use cases for behind-the-meter storage

APPLICATION:	USE CASE:
Peak reduction/shaving	Certain tariff structures are constructed such that customers' energy costs increase significantly if their peak demand crosses a certain threshold. Peak reduction/shaving using storage involves discharging batteries during these periods to reduce the peaks of the energy demand of a facility to prevent demand charges.
Load shifting	Customers on a time-of-use tariff structure may use batteries to shift their load such that less energy is used during peak times, with batteries charging using cheaper, off-peak tariffs and then discharging during peak tariff periods to offset consumption.
Backup power	In the event of interruptions to the power supply, whether due to loadshedding or any other planned/unplanned outage, batteries can serve as backup power with the benefit of avoiding diesel costs of running backup generators
The improved utilisation rate of PV installations	The installation of BTM storage can complement embedded PV installations when excess solar generation is used to charge the batteries, allowing them to discharge during times of reduced generation to further offset energy costs. Furthermore, some municipalities, using batteries to export to the grid at a higher export tariff might also be possible.

4.3.2.2 Improved energy security and quality

Dependence on the national grid, which has been affected by issues like capacity constraints and attendant loadshedding, has led to significant disruptions for local businesses. Renewable energy projects allow companies to generate their power, and when paired with battery storage, they reduce reliance on the unstable grid and improve the quality of the power supply. These systems also help stabilise voltage and frequency, minimizing the risk of power quality problems that could damage equipment or disrupt operations. As a result, businesses benefit from smoother, more reliable operations.

4.3.2.3 Energy Security

In recent years, loadshedding has played a key role in driving the uptake of BTM storage as customers installed systems to reduce the impact of loadshedding on their businesses. As a response to unprecedented levels of loadshedding in 2022 and 2023, the Li-ion BTM storage grew rapidly to meet this demand for backup power Figure 14 illustrates the escalating stages of loadshedding, with each additional stage representing a gigawatt shortfall in Eskom's supply. Plotted on the same figure is are the annual values of imports of Li-ion cells and batteries to South Africa, which spiked in relation to loadshedding. The close relationship between elevated levels of loadshedding and demand for the technology is apparent from the figure.

In 2024, loadshedding decreased substantially compared to previous years, with the country experiencing nine months without outages starting 26 March. As a result, a major driver for growth in the BTM storage market diminished. This shift had a notable impact on demand for smaller-scale BTM storage installations, particularly in the residential sector, where demand dropped sharply. The future of loadshedding and its impact on the market remains uncertain as Eskom continues to rely on its ageing coal power fleet. The combined effects of Eskom's improving performance, the connection of new generation capacity to the grid, and a decrease in overall grid demand will determine whether loadshedding persists in the coming years.

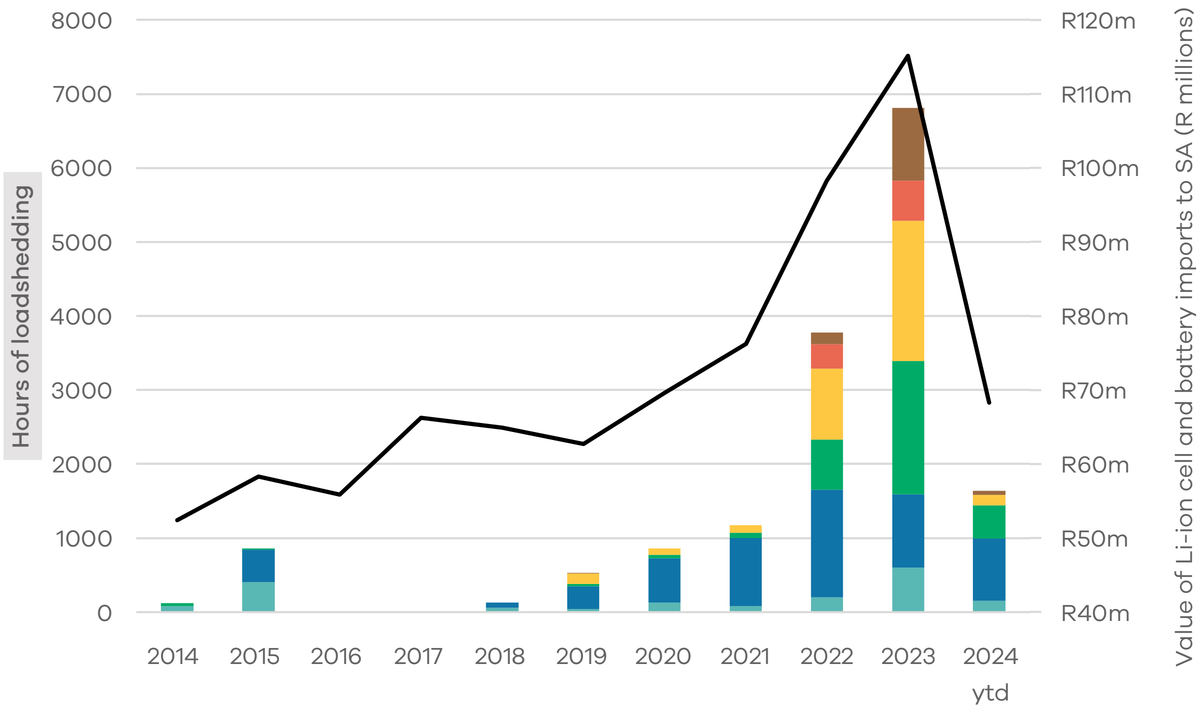

Figure 14: Loadshedding severity and imports of Li-ion cells and batteries to South Africa
Sources: Adams, 2024; Eskom, 2024a; Centre for Renewable & Sustainable Energy Studies, 2024; Trademap, 2024

However, the long-term risk of supply and demand imbalances due to ageing infrastructure remains a concern for businesses. In 2024, some areas have been affected by another type of planned outage called "load reduction." Unlike loadshedding, load reduction occurs in areas where transformers are at risk of damage from overloading. This new source of potential power instability, along with regular outages and grid disruptions, is prompting businesses to invest in backup power solutions like Li-ion storage, regardless of loadshedding prospects.

4.3.2.4 Improved energy quality

Renewable energy systems, particularly when combined with energy storage solutions, can enhance the quality of power supply. Electrical power quality refers to voltage and current quality at the end-user of electricity. Most production processes and business models rely on electricity; if the quality of the electricity is insufficient various problems may arise. An example of such problems is the well-known operational risk of a voltage dip event that can stop a production line when only one piece of equipment in a serial processing plant is affected. Onsite storage can help stabilise voltage and frequency, reducing the risk of power quality issues (illustrated on Figure 15) that can damage equipment and/or disrupt operations. Figure 15 illustrates an electrical power quality issue over time, showing fluctuations in both load (green line) and grid power (red line). It demonstrates how grid power varies throughout the day, with periods of stability and sudden drops, showing the potential for voltage dips that can affect production processes and highlighting the need for a system to stabilise power supply which can be achieved by renewable energy systems with storage. As businesses look for ways to manage ongoing grid challenges and the risks posed by grid instability, Li-ion storage continues to provide effective protection against both loadshedding and unforeseen power quality and supply issues. The technology has proven its value in supporting reliable operations, regardless of grid stability, and is likely to remain a key element in strategies for energy security in an increasingly uncertain energy landscape.

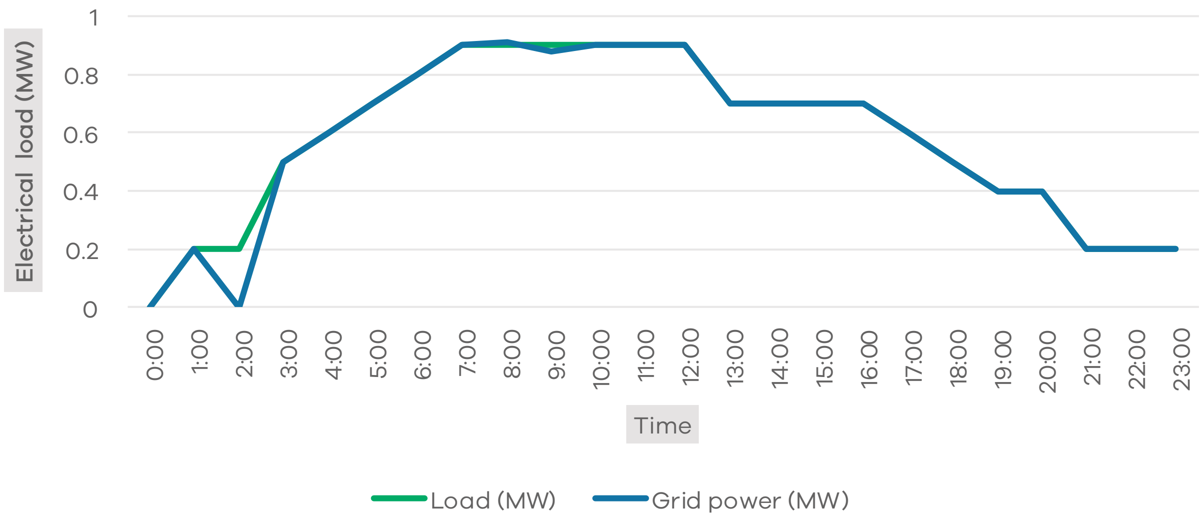

Figure 15: Illustration of typical electrical quality of supply issue experienced by a grid-connected C&I customer

4.3.3 Barriers

The market for BTM storage has been subject to significant demand and supply fluctuations as a result of the suspension of loadshedding. Furthermore, the relative nascence Li-ion technology for large-scale applications paired with the high reliance of the industry on imported cells and components pose challenges for stakeholders in the local Li-ion value chain.

4.3.3.1 Nascent regulatory environment

The lack of clear policies, regulatory frameworks and standards for BTM Li-ion storage creates barriers to the growth of the BTM Li-ion storage market. One of the most pressing challenges is the limited guidance on battery installations in national safety and installation standards[19]. The thermal runaway phenomenon in Li-ion batteries presents a fire hazard that, coupled with the industry's nascence, increases risks for both installers and owners. Unlike other industries, where safety protocols for hazards like fires are well-established, standards for handling and mitigating Li-ion fires are still under development internationally. This lack of clarity regarding safe practices and fire suppression protocols leads to uncertainty, making businesses hesitant to invest in BTM Li-ion storage systems.

The perceived risk of fire, especially given that improper installation or operation can increase the risk of Li-ion-related fires, can deter businesses from procuring these systems. A lack of understanding of these risks in the banking and insurance industries can make it more difficult and expensive for companies to access finance and insurance for BTM storage installations.

Moreover, the limited guidance and application/awareness on battery installations within electrical installation standards and building standards highlights the need for amendments to better cover battery storage. Implications for positioning of batteries, and the need for appropriately trained and skilled personnel during installation, as well as the use of quality components are some of the key challenges in the market.

19 SANS 10142-1 "*The wiring of premises — Part 1: Low-voltage installations*" is being amended to include additional battery installation requirements

The lack of clear policy, gaps in safety standards, and limited regulatory oversight creates uncertainty, raising both perceived and actual risks for businesses. This barrier not only affects market growth but also makes the adoption of BTM Li-ion storage more challenging, particularly for new entrants who may struggle with the added complexity and cost.

4.3.3.2 High reliance on imported components

The majority of Li-ion battery cells and associated components in South Africa are imported, leaving the market, vulnerable to delays, supply chain disruptions, and price fluctuations. Long lead times on imported equipment are a consistent challenge for local value chain actors, largely due to inefficiencies at South Africa's ports. Cape Town's port, in particular, was ranked the worst-performing globally out of 405 ports in the World Bank's 2024 Container Port Performance Index, which measures port performance based on the average vessel time spent in port (The World Bank, 2024). To mitigate these delays, suppliers often need to carry larger inventories, which can strain their cash flow and increase the working capital required for these technology providers to remain competitive. Additionally, quality issues with imported components have been reported by the industry. Despite undergoing approval and type-testing to get international standard ceritificationcertification, subsequent shipments of the same products often arrive with lower quality than the originally certified items. These substandard components are shipped under the same classification as the approved products, raising concerns about non-compliance with standards and undermining trust in the supply chain.

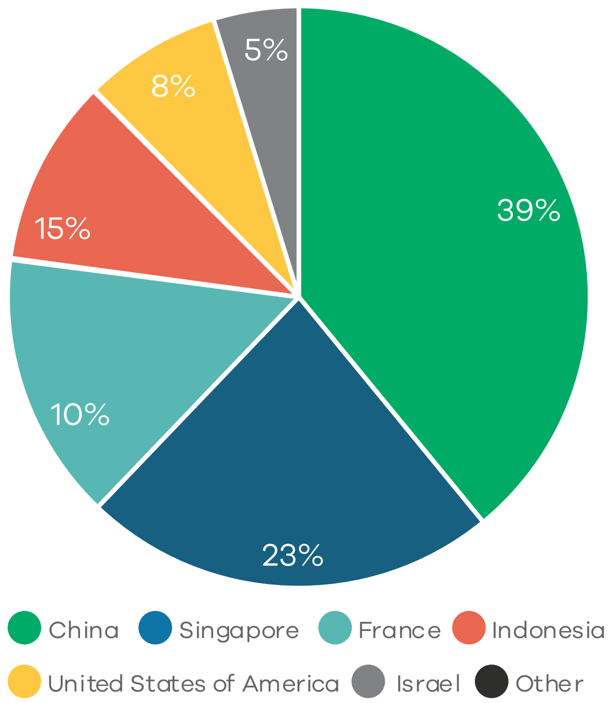

Figure 16: Breakdown of the value of Li-ion cell and battery imports by country (2019-2024,Q2)

Source: Trademap, 2024.

Figure 16 illustrates the breakdown of Li-ion cell and battery imports into South Africa over the past five years by the exporting country. It highlights the market's heavy reliance on Chinese imports, with nearly 40% of all Li-ion cells and batteries coming from China. This dependency poses a risk to supply chain stability and price security, due to potential changes in trade conditions, as well as risks associated with fluctuations in exchange rates.

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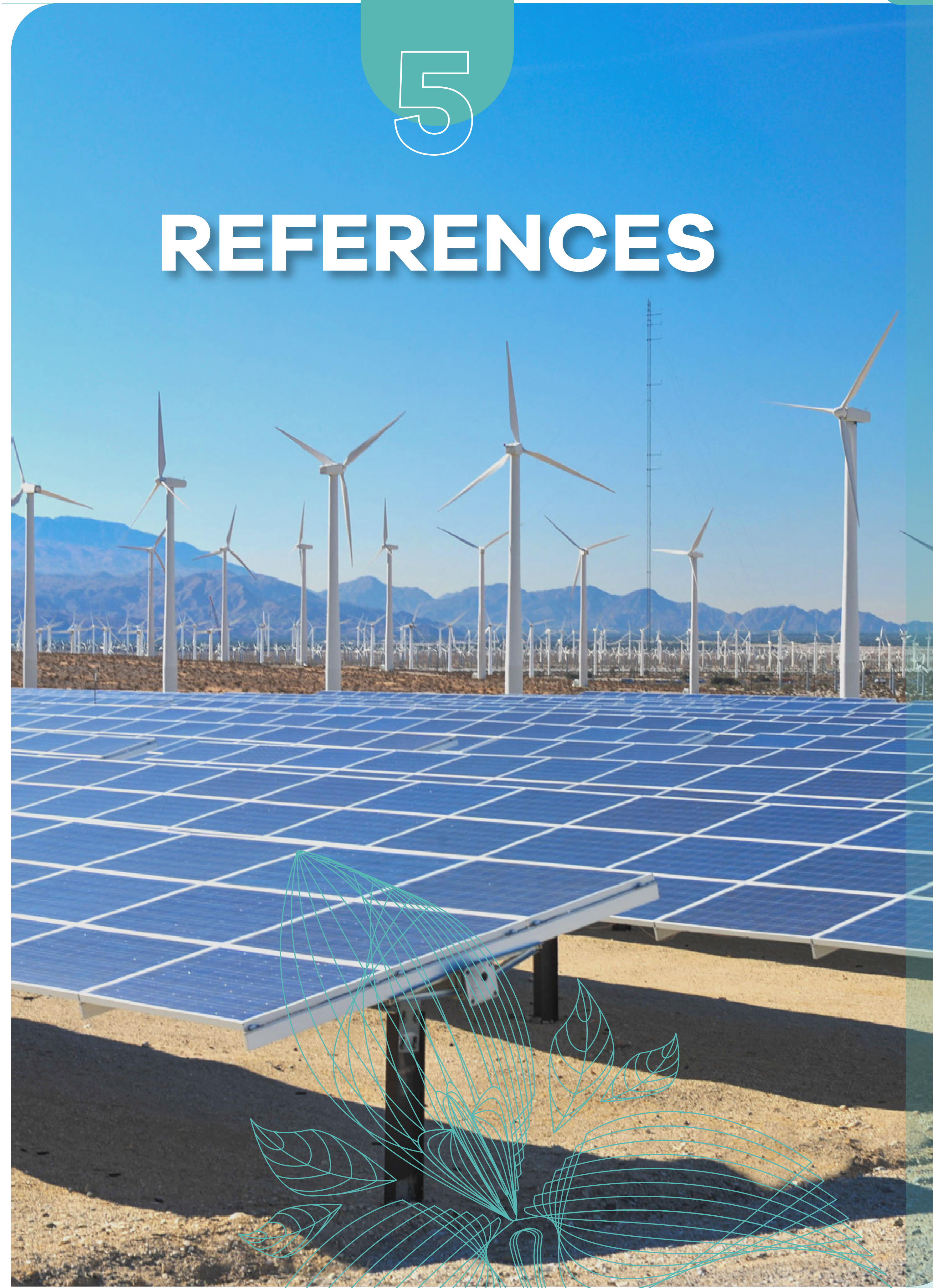

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